Richard C. Kenney

SECOND EDITION.

THE Photographic Amateur.

By J. TRAILL TAYLOR.

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THE PHOTOGRAPHIC AMATEUR:

A SERIES OF LESSONS IN FAMILIAR STYLE FOR THOSE WHO DESIRE TO BECOME PRACTICALLY ACQUAINTED WITH THIS USEFUL AND FASCINATING ART.

SECOND EDITION.

BY J. TRAILL TAYLOR,

EDITOR OF THE PHOTOGRAPHIC TIMES AND AMERICAN PHOTOGRAPHER; LATE EDITOR OF THE BRITISH JOURNAL OF PHOTOGRAPHY, LONDON; HONORARY MEMBER OF THE IMPERIAL POLYTECHNIC SOCIETY OF RUSSIA; THE EDINBURGH PHOTOGRAPHIC SOCIETY; THE ASSOCIATION OF OPERATIVE PHOTOGRAPHERS OF NEW YORK; THE LONDON PHOTOGRAPHIC CLUB; AND THE LONDON AND PROVINCIAL PHOTOGRAPHIC ASSOCIATION.

NEW YORK:
SCOVILL MANUFACTURING CO., 419 & 421 BROOME STREET.
W. IRVING ADAMS, Agent.

1883.

PREFACE TO THE SECOND EDITION.

IT is extremely gratifying to both author and publishers to find that the large edition of five thousand copies of the "Photographic Amateur," which has scarcely been a year before the public, is now so nearly exhausted as to necessitate the preparation of a second edition.

After a careful reperusal of the first edition, the author does not discover any chapter in which the discussion of a special topic could be more effectively treated by him than has already been done. There were, however, a few small matters which were susceptible of improvement, and these have received attention. Some revisions have been made, and a few pages added to the supplement, by which the utility of the work to both the professional and the amateur photographer will be enhanced.

NEW YORK, December, 1882.

PREFACE TO THE FIRST EDITION.

WHEN one is being conveyed through scenes of a grand, charming, and ever changing character, he usually becomes, in sentiment at any rate, an artist in spite of himself In the varying forms assumed by mountains, trees, valleys, villages, or cottages, he instinctively tries to realize how these would look in a picture, and this, in turn, engenders the thought of how pleasant it would be if by means of some portable photographic apparatus, involving in the use thereof neither trouble nor the possession of special skill, transcripts of such natural beauties could be secured to serve as reminiscences of the trip or for the gratification of friends at home.

America teems with scenes at once lovely and grand, of which its citizens are justly proud. But it would seem to require the European who is familiar with the lakes and glens of Scotland, the mountains and secluded villages of Switzerland, and the scenic beauty of the Rhine, to correctly appreciate the scenery of the New World. At any rate, not content with a passing glance at Nature in her loveliest and grandest forms, the cultivated English tourist in numerous cases carries with him a portable photographic camera, with a large assortment of ready prepared sensitive plates, upon which, by means of a trigger movement, instantaneous impressions are secured, ready to be developed either in the seclusion of hotel life when it suits convenience, or after his return home. In the summer of last year, Col. Stuart Wortley, who with Mrs. Stuart Wortley visited Australia, Tahiti, and other islands in the Pacific, on his return to England developed 400 negatives taken during their tour, all of them success-

ful, and many of them possessing merit of such a high order as to have led to a request for their being publicly exhibited.

Neither Arctic nor Alpine tourists now think of undertaking their arduous journeys without being provided with a complete portable photographic outfit; while the descriptions of foreign scenes sent home by missionaries are supplemented in an invaluable manner by the photographs taken by themselves and sent in illustration of such description.

There is not a member of the royal family of England who is not familiar with the working details of photography, the Prince of Wales being President of the Amateur Photographic Association of Great Britain. The Earl of Caithness, whose lamented death, while on a visit to America, in the Fifth Avenue Hotel, New York, has been recently recorded, was an accomplished amateur photographer, and Vice-President of the active Association of Amateurs just named. The second chief dignitary of the Church of England (the Archbishop of York), an energetic member of the same society, devotes much of his leisure to the practice of the art. From the judges on the bench down to the attorney's clerk are to be found devotees of photography; the amateur camera is the handmaid of the artist, the cherished companion of the tourist, and the valued plaything of the toilers at the desk, the counter, or the work-bench, who all find in it a relaxation from the cares of business.

Practical photography is now reduced to a state of absolute simplicity and certainty, and the following directions for taking pictures by both the dry and wet processes are written exclusively for those who are presumed to be entirely unacquainted with photography. To this is to be attributed the extremely simple and elementary nature of the instructions, which, if carefully followed by a person of ordinary intelligence, will insure his being able to produce pictures, either as landscapes, portraits, or groups, that will be a source of satisfaction to himself and of gratification to his friends.

New York, December, 1881.

THE PHOTOGRAPHIC AMATEUR:

A Course of Concise and Practical Instructions in the Art of Photography.

CHAPTER I.

PRELIMINARY ARRANGEMENTS.

THE OPERATING ROOM—WET AND DRY PLATE PHOTOGRAPHY—SELECTING APPARATUS—FOCUSING.

The Operating Room.—The first thing to be noted by the lady or gentleman who proposes becoming an amateur photographer is this: No ray of light, not even of the feeblest nature, must be allowed to fall upon a sensitive plate, else it will be destroyed. The nature of the destruction cannot be perceived at the time, as no visible change takes place; but at a subsequent stage, when the developer is applied, the plate will be found to darken all over, generally known as "fogging."

How, then, it may very pertinently be asked, is the plate that is to be sensitive to light prepared, examined to see if it be free from blemishes, and subjected to the various manipulations required without light sufficient to enable these operations to be seen? We reply—while ordinary daylight or any light of a white or even blue color exercises this deleterious power, it is happily the case that yellow or red light has so little action

upon a sensitive plate that it may be freely exposed to it without harm. Photographic operations must therefore be conducted in a room into which no light is admitted but what passes through a yellow, or by preference a deep orange paper or calico blind, or through glass of a ruby color. This permits the plate to be easily seen without its being damaged by the action of the light. An operating room lighted in accordance with the principle just laid down is designated a "dark room."

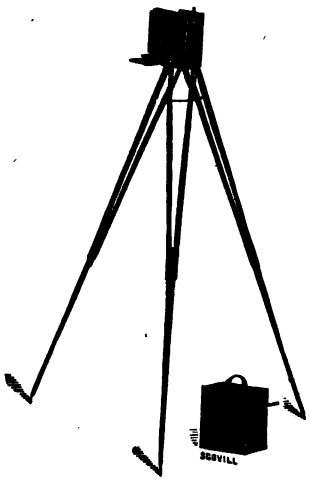
Wet and Dry Plate Photography.—Photographic practice at the present time is divided into two parts, each determined by the fact of whether a supply of sensitive plates is kept ready prepared for use upon any emergency, or whether the whole operation of preparing the plate is performed just at the time of taking the portrait or landscape. These two photographic divisions are termed "dry plate photography" and "wet plate photography." Owing to the great importance of the former, especially to amateurs, tourists, or those who like to do a little *dilettanti* work, and also owing to the further fact that it is now being very much adopted by the professional portrait photographer, *dry plate* photography will form a leading theme in this manual.

Selecting Apparatus.—In selecting apparatus, regard must of course be had to the special object that is in view.

A camera that might be very suitable for the practice of portraiture in a garden, conservatory, or well lighted room would probably prove much too cumbrous to form part of the baggage of a tourist who preferred to accomplish much of his journeying on foot. For this class cameras exceedingly light, portable, and rigid have been devised, and by their use many pleasing mementoes of travel are secured for future recreation at the fireside.

For the amateur, the apparatus that will prove the most useful is one adapted both for views and portraits, and such are now made in a state of great perfection. Cameras of the strictly portable class in-

tended for every purpose for which an amateur can desire them, and suitable for both portraits and landscapes, for plates wet or dry, are now readily obtainable from any respectable photographic stock house. The favorite sizes of plates are 4 x 5 inches when the camera is desired to be so portable as to go into the pocket, or 5 x 8 inches when the services of a satchel are required for carrying it. The larger size enables us either to take one picture the full size, two smaller and different pictures on one plate, or a stereoscopic view.



The stand upon which the camera is to be erected while in use must possess a degree of rigidity sufficient to keep it quite steady, for if it is allowed to vibrate by a slight wind, the resulting pictures will not be so sharp as they would otherwise be. Camera stands possessing both portability and lightness, as well as great rigidity, may now be obtained from all the leading dealers.

Focusing.—Having become to some extent acquainted with the mechanism of the camera, its plate holders and camera stand, and having obtained some degree of proficiency in obtaining on the ground glass focusing screen a very sharp image of such objects as the lens is directed to, the intelligent amateur will have noticed that, when examining the image upon the ground glass, such examination is greatly facilitated by a dark cloth of a pliable texture thrown over both his own head and the camera, to exclude light from behind. This is technically known as the "focusing cloth," and is employed by every photographer. Black cotton velvet is the fabric out of which it is usually made, although a pliable kind of thin india rubber cloth, known in commerce as "zephyr cloth," possesses exceptionable advantages on account of its extreme thinness, flexibility, and opacity. A square yard of this material, when folded up, forms a very small package indeed; and if a shower of rain

overtake the photographer when his camera is in position, it may be thrown over the apparatus, in the certainty of its not allowing a drop to pass through.

Another useful aid toward focusing sharply is a pocket magnifying glass. Probably the most convenient form in which this aid can be found is in that of the black horn eyeglass commonly used by watchmakers. The special value of this consists in the ease with which, after a little practice, the muscles surrounding the eye can be made to grasp and clasp the eyeglass to the eye, thus allowing both hands to be at liberty. The focusing cloth having been fastened to the camera by means of a rubber band or piece of string, the eye of the photographer, armed with this magnifying power, is now free to travel all over the image delineated on the ground glass, and see that the sharpness is such as to satisfy the most fastidious requirement. This the operation of the rack and pinion, or other mode of adjustment, readily permits to be done.

It also greatly facilitates the proper selection, or, more correctly, the adjustment and examination of the picture on the ground glass screen, to employ when doing so the widest aperture of which the lens is capable. For this purpose one cannot have too much light, as it permits of the pictorial effect being easily seen. When this has been adjusted, then insert the smaller diaphragm that has been determined upon to use in taking the picture, and finally complete the focusing after the working diaphragm has been inserted.

CHAPTER II.

DEPTH OF FOCUS AND THE USE OF DIAPHRAGMS.

THE careful observer will have noticed that an object close to the camera necessitates the lens being removed to a greater distance from the focusing screen to obtain sharpness than when the scene or object to be photographed is situated at a considerable distance. In this connection he will also have noticed that all objects beyond 60 or 100 feet from the camera are equally sharp, and hence he will not unreasonably surmise that,

for the purposes of securing sharp pictures of landscapes, one focusing and adjustment of the lens, with a mark placed to show that adjustment, will serve in every case hereafter, and in this he will have reasoned aright. When a very sharp picture of some distant object—that is, something beyond a few hundred feet away—has been obtained, the landscape photographer, whether amateur or professional, may rest assured that if he has made a scratch or other mark on the sliding portion of his camera or lens, every picture taken in future will be equally sharp if, when working under similar conditions of distance, these marks are made to coincide.

At this place it may be desirable, if only for future reference, to introduce the rule which has special reference to this subject; but the knowledge of or attention to which, be it premised, is not at all essential to the ability to take a photograph possessing the utmost degree of sharpness. It is introduced for the sake of those who prefer looking beyond practice to principles. The rule is simple, and is as follows: When a very small stop or diaphragm is used—say one having an aperture equal to one-fortieth of the focal length of the lens—allow four feet for every inch of focus possessed by the lens that is being used, and everything beyond that distance will be pictorially sharp. To apply this to practice: A favorite focal length of lens for cameras producing 4 x 5 inch inch plates is 6 inches, because with such a lens used upon a plate of those dimensions a very harmonious picture is obtained, neither too wide nor too narrow in its included angle of view. Well, when focusing this lens, and using a small diaphragm, the depth of focus, or depth of pictorial delineation, is such that everything beyond twenty-four feet from the camera will be well defined when anything exceeding such distance is sharply focused. From this it will be seen that the shorter the focus of the lens the greater will be its range of pictorial depth of focus.

The Use of a Diaphragm.—Before proceeding farther it may be well to reply to questions which sooner or later will frame themselves in the mind of the amateur: Why employ a diaphragm or stop; of what use is it? What compensation does it afford for preventing so much light from entering the

lens, and thereby making the photographic action all the more slow? We answer, that an equal degree of sharpness in very near objects and those at a greater distance can only be obtained when the lens is stopped down by means of a diaphragm, and the smaller the aperture in the diaphragm, the more extended will be this range of definition, not only as regards depth—that is, from front to back—but as regards the sharpness at the extreme sides of the view. It will from this be obvious that when a definite object—say a portrait—is to be taken, a much larger diaphragm may be employed than when the subject forms a group, some members of which are at a distance from the central or principal figure.

What has here been said has no reference to any special class or description of lens, but applies to every one irrespective of its nature. The principle is the same both in its application to portraits, groups, or scenery.

When taking groups in the open air, we may say that, for obvious pictorial reasons, it is not desirable that the distance or the natural surroundings be quite so sharp as the figures themselves; and from this consideration arises the rule, that the larger the opening of the lens the more plucky will be the picture, the "pluck" in this case meaning the superior brilliancy and sharpness of the chief subjects in the photograph as contrasted with its surroundings. This is also the case when taking portraits in a gallery or studio. Care should be taken not to allow the background or studio furniture or accessories to be as sharp in focus as the figure, to which everything should be subordinate. This topic will be specially considered farther on, but even at this stage of our progress it is well to bear it in mind.

CHAPTER III.

DRY PLATE PHOTOGRAPHY—THE PREPARATION OF DRY PLATES BY THE BATH PROCESS.

Dry plates are prepared in two different ways, by the *bath* process and by the *emulsion* process. In the former the plates receive a coating of collodion, and are then made sensitive by

being immersed in a bath containing a solution of nitrate of silver, by which iodide or bromide of silver, the sensitive material, is formed in the film. In the emulsion process the bromide of silver is mixed with the collodion or gelatine, and the plate is sensitized by the simple act of coating it with an emulsion of that nature.

While we strongly advise the amateur to commence his photographic career by purchasing his sensitive plates ready prepared, it is yet desirable that he be possessed of the knowledge necessary by which to prepare for himself plates not inferior to any which are to be met with in commerce. There is frequently a high degree of pleasure and satisfaction experienced in making one's own plates, even although many who are quite masters of the art of doing so prefer, from motives of convenience and certainty, to obtain them ready prepared from some reliable dealer or manufacturer.

The Bath.—In order to prepare a bath plate by either the wet or the dry collodion processes, the first requisite is the bath in which the necessary solution is to be contained. This may be either of a vertical form, in which the plates are to be immersed end down, or may consist of a flat dish or tray. The most convenient form is the vertical, which is that almost invariably made use of by professional portraitists. Bath holders are made both of glass and vulcanite. The former is the best on account of the facility it affords for seeing impurities in the solution; but for portability the latter possesses advantages on account of its lightness. Professional portrait photographers invariably make use of glass vessels; many of those landscape photographers who still adhere to the "wet process," when in the field select the vulcanite on account of its lightness. Apart from portability, glass baths are to be preferred to any other kind.

The dipper, by which the plate is lowered into the bath, is made of glass, silver wire, or vulcanite. The last mentioned is the best, and is that most commonly employed by professional photographers. At the lower end are two hooks or buttons upon which the plate rests when it is to be immersed.

The Silver Bath Solution.—Previous to describing how this is made, it may be stated that its method is the same for the portraitist who takes his scores of negatives a day as for the amateur who may only use it once a week. Upon its condition and good working depends in a large measure the quality of the pictures that are obtained.

It is prepared by dissolving crystals of nitrate of silver in distilled water, in the proportion of thirty-five grains of the silver to each fluid ounce of water. This is then ready for use, subject, however, first, to its being rendered slightly acid by the addition of two or three drops of nitric acid to the whole quantity of solution, which may be several pints. The solution has also to be iodized; this may be done by adding a few drops of a rather weak solution of iodide of potassium, which will produce a turbid yellow appearance from the formation of iodide of silver which, however, will gradually be dissolved by the silver solution. Many operators prefer to iodize the bath solution by coating a plate with bromo-iodized collodion and immersing it into the silver bath (as the nitrate of silver solution is commonly designated), allowing it to remain for one or two hours. Previous to the immersion of the plate the coating of collodion was clear, but no sooner is it plunged into the silver bath than it becomes of a milky appearance, only somewhat yellower in color. After the plate has been an hour in the solution it will probably be found to have nearly resumed its original transparent appearance.

Collodionizing the Plate.—Combining explanations with directions as we go on, we pause for a moment to explain in what manner the plate may best be coated with collodion, and also the change that takes place when it is immersed in the silver bath.

Take hold of the plate, previously made quite clean, at one corner by the forefinger and thumb of the left hand, and holding it as level as possible pour quite deliberately, and without stopping, a small pool of collodion on the center. Now lower very slightly the corner nearest you on the right hand until the collodion flows up to it, and then depress in a similar way the

nearest corner on the left, then the farthest left corner, and last of all the farthest right hand corner. In this way is caused a kind of undulatory motion of the plate by which the collodion is made to flow evenly all over the surface. The surplus is then poured back into the bottle, the plate being held at an inclination, and not in a vertical position, while this is being done. Do not keep the plate motionless while the surplus collodion is being drained off, but give it a slow rocking motion edgeways to prevent the formation of ridges. Do this with the utmost coolness and deliberation; by getting nervous and flurried the probability is that some of the collodion will be spilled and the plate badly coated; but, notwithstanding this, it may be safely affirmed that, after making one or two careful attempts in this manner, the coating of a plate with perfect evenness will ever afterward be found an easy matter.

Having allowed the film to set for a few seconds, the plate is then placed on the dipper and gently lowered down in the silver bath. In doing so only one precaution is necessary—do not stop when the plate is half way down, but let the motion be continuous, otherwise a line will appear in the picture where the stoppage was made.

Explanatory Note.—While the plate is in the silver bath we shall explain the nature of the chemical action that takes place during the few minutes it is being immersed. The collodion contains in solution certain iodides and bromides, say those of cadmium or ammonium. When these come into contact with the nitrate of silver solution, the silver leaves the nitric acid with which it had formerly been in combination and forms a union with the iodide and bromide in the collodion, the result being the formation of iodide and bromide of silver, which, being opaque, cause a dense milky appearance to be assumed by the film. As it it takes from two to ten minutes to effect the change in its completed form, the plate must be allowed to remain for a certain time in the bath. Four or five minutes forms a suitable time for collodion of the ordinary kind, and when thus prepared a collodionized plate is exceedingly sensitive to light. The exceptions to this general rule

will be found described afterward when speaking of collodion prepared for exceptional purposes.

The reason for iodizing the silver bath and the chemistry involved in it may be compressed in a few words. The iodide of silver, as formed in the film when the plate is immersed in the bath, is soluble in a fresh solution of nitrate of silver; therefore, if the plate be allowed to remain in the bath after the iodide of silver has been formed in its film, such iodide will again be dissolved out by the bath. Here follows the fact that is of special value: The bath solution is capable of dissolving only a very small portion of the iodide, and, when once its appetite for this has been appeased, it is for evermore helpless in this direction, its power for mischief is gone, and gone forever. The intelligent reader therefore sees that it matters very little whether an addition of iodide of silver is made to the bath in the first instance on which to allow it to satiate itself, or whether a plate is coated with collodion and allowed to remain in the bath for one or more hours in order to allow the silver solution to feed itself upon the chemical child it has been instrumental in producing. The result is the same in both cases, and both methods of iodizing the bath are practiced by the ablest photographers in the world. The operation is important, although very simple, and it occurs only once in the lifetime of any silver bath.

The silver bath is a most important element in the operations and outfit of the photographer. It is instrumental in the production of every portrait that is taken, whether as a *negative* from which to produce prints on paper, as the means of producing ambrotypes, ferrotypes, transparencies for the stereoscope or magic lantern, or—to meet the case now specially before us—in the production of sensitive dry plates, to be used for taking negatives in the camera as occasion requires. The remarks we have made on its preparation, however, apply to every purpose in the whole realm of photography. When modifications are necessary or desirable, they will be indicated at the proper time.

The Modus Operandi.—To prepare a dry plate by the bath process, then, it is only requisite that the plate be

coated with collodion of the commercial sort, and sensitized by being immersed for four or five minutes in the silver bath, which is all the preparation required for a "wet plate" on which a portrait or view is to be taken at the time. Up to this stage, therefore, the preparation of the plate meets every requirement—that of the professional portraitist whose sitter is waiting in the adjoining room, or the landscapist who desires to take his picture next day or next month; only in the former case it would be transferred to the camera just as it is, whereas in the latter it would have to be first dried before being put away for future use.

If the plates on removal from the silver bath were allowed to dry, the chemicals with which the film is imbued would crystallize, and in doing so would disintegrate the film, hence they must be removed by subjecting the plate while still wet to a thorough washing with water. Some do this by means of a faucet from the water tap, others by means of a flat dish filled with water. In either case the sensitive film is washed free from such saline matters as are of no use but positive detriment to the finished plate, and by no amount of washing can the sensitive atoms imbedded in the film be removed.

CHAPTER IV.

PRESERVING THE SENSITIZED PLATES—THE SUBSTRATUM.

Dry Plate Preservatives.—At this stage it is necessary, previous to drying the plate, to coat it with some application by which the pores of the collodion will be filled up, so as to render it amenable to the action of the developing solution which is afterward applied. This preservative liquid should also enact the part of a varnish to protect the film from injurious atmospheric influences during the days, months, or years that may transpire between its preparation and its being used. The preparations that have been advocated for this purpose are innumerable, among them being gelatine, gum, albumen, glycerine, syrups of various kinds, infusion of malt, coffee, tea, tannin, hops, and many other things besides.

Of these, two have attained a great degree of popularity, viz., tannin and coffee. If tannin is to be employed as the preservative let it be dissolved in water in the proportion of ten or twelve grains to the ounce, and let this be poured over the sensitized surface still wet from the water from which it was washed, taking care that it flows over every part. The plate is then placed aside to dry either spontaneously or by a gentle heat. The result of this would in photographic parlance be designated a "tannin plate," and the finished negative would be a "tannin negative."

If coffee be used as the preservative let it be prepared by placing a dessertspoonful of ground coffee in a cup of medium dimensions, pouring over it boiling water to the extent of more than half filling the cup, and allowing it to stand until cold, with an occasional stirring up. Now strain the liquid through muslin and the preservative solution is complete. It is applied in the same manner as the tannin solution already described. Pictures of exquisite character have often been obtained from the use of either of these preservatives. The plates when packed away for use may be kept with great advantage in a grooved box or "negative plate box," special care being taken to protect them from the light.

In the Appendix will be found a few more of the preparations employed by the best photographers for preserving their plates, and by all of which prizes for the best pictures at various exhibitions have been won. The two classes of preservative here mentioned are not given as being any better than others, but rather on account of the facility with which they can be prepared.

The Nature and Use of a Substratum.—It is often the case that, owing to the washings and treatment the negative has eventually to undergo, the collodion film is loosened on the plate and is in danger of being washed off entirely. This can be obviated by several methods, the most commonly employed of which consists in flowing over the surface of the clean glass plate a diluted solution of albumen. The white of one egg beaten to a froth in a pint of water is a sufficient strength for the purpose, and some prefer it still

weaker. Ten or twelve drops of strong ammonia should be added to prevent it from decomposing. Instead of being *flowed* over the surface, the diluted albumen may be applied by means of a piece of clean sponge dipped in the liquid and then pressed so as to leave no more than will suffice just to moisten the plate when it is rubbed over it. It is wonderful how extremely attenuated the film may be which serves to bind firmly the collodion film to the glass. In "gallery" parlance, plates thus prepared are said to be *albumenized*, and a stock is always kept ready on hand for the use of the operator. It is almost needless to observe that the albumen must be quite dry ere applying the collodion; but as it dries with great rapidity, the two operations of albumenizing and coating with collodion may go on continuously.

A somewhat simpler method, much employed by many, consists in rubbing the cleaned surface of the plate with a small muslin bag containing powdered steatite, commonly sold under the name of French chalk. This imparts a sort of unctuous influence to the glass, in virtue of which it retains the collodion film in close adhesion. It may here be remarked that although it does this, and very perfectly, so anomalous and eccentric is its action, that after the picture is quite finished and dried it forms by far the best and easiest preparation for enabling the film to be entirely removed from the glass, and, if desired, transferred to the leaves of a folio. But the subject of the transferring of films will come to be treated in due course hereafter. For holding the plate firmly during either this operation of "chalking," or the previous one of cleaning the surface of the glass, a plate vise is very useful. Its nature is shown in the adjoining illustration. Plates of any dimensions may be firmly held by the movable jaw of the vise, which is operated by a handscrew.

An extremely diluted solution of gelatine has, by some skillful operators, been preferred to albumen. The strength rec-

ommended is sixty grains of gelatine dissolved in ten ounces of water, to which must be added two and a half grains of chrome alum dissolved in a little water. Stir well and filter, and keep warm.

Taking a Negative.—Let us now suppose that we have got a plate of the foregoing kind in the plate holder or shield, and that a negative of an outdoor scene is to be taken. Focus the image sharply, recap the lens, insert the plate holder, withdraw the slide by which the plate is shielded from the lens, and, lastly, uncap the lens. Carefully note the number of seconds or minutes allowed for the exposure, and then cap the lens, insert the sliding shutter of the plate holder, and put the holder away until the precincts of the dark room have been reached and it is safe to remove the plate. The exposure given in the camera may be from a quarter to a half minute to commence with, and from its appearance when developed the beginner will soon perceive whether such exposure has been too short or too long.

It is impossible to indicate the exposure that should be given any nearer than this without knowing the strength of the light, the nature of the subject, and the aperture of the diaphragm in the lens. Common sense, without the possession of any photographic knowledge or experience, dictates the fact that an infinitely shorter exposure should be given to a white house lighted by a blazing sun than to a deep ravine on a dull evening. The judgment that enables one to hit an exposure with accuracy is very soon acquired by a little experience. It may also be remarked that the plates whose preparation we have here described are not at all highly sensitive, but are of the slow but sure kind, in whose exposure a considerable degree of latitude may be indulged in. We shall, later on, describe in what way plates may be prepared possessing the extreme of sensitiveness, and which necessitate for landscape work a drop shutter with a trigger attachment.

To Develop.—Remove the plate from the shield and wet the surface by pouring on it a little water. Some operators hold the plate by the corner with the thumb and finger during the

operation of developing, but it soils the fingers to a terrible extent and causes black stains on the hands. Of the various appliances for holding the plate the pneumatic holder is the most convenient. A method we frequently adopt of holding a plate during development, when a suitable holder is not at hand, deserves to be known on account of its merit. It consists in taking a plate of glass a little longer than the plate to be developed, laying upon one-half of it a piece of well wetted blotting paper, and pressing the sensitive plate down upon this. So tenacious is the hold upon the plate that it may now be turned upside down without falling off, using the lower plate as a handle.

After wetting the surface apply a solution composed of pyrogallic acid, four grains; water, one ounce.

This should be applied out of a small glass or porcelain measure, an egg cup forming one of the most appropriate vessels for the purpose. In a short time a very faint, feeble indication of a picture will appear. So feeble may it be as sometimes not to be easily discerned at all unless by careful examination. Now allow the pyrogallic acid solution to be drained from off the plate and back into the little developing cup, and then add to it one or two drops of a solution composed of ten grains of nitrate of silver and ten grains of citric acid to an ounce of water. This when reapplied to the surface of the plate will cause the feeble details of the picture to acquire intensity. Instead of the one or two drops recommended to be added it may sometimes be necessary to add more than twice such quantity; but the softest and most harmonious pictures will be obtained when a very sparing use is made of the intensifying addition of silver. The object of the presence of citric acid is to prevent the plate from being darkened or "fogged" all over. Citric acid, as well as acetic, tartaric and other acids, prevents the deposition of the silver on any parts but those which received the image in the camera. When the details appear to have a proper degree of intensity the plate is washed and immersed for one or two minutes in a saturated solution of hyposulphite of soda in water, by which the opalescent film of iodide of silver is cleared away, leaving nothing remaining but the negative image.

It is from an examination of the image at this stage that the novice is enabled to discover whether he has given too long or too short an exposure in the camera. If well lighted objects in the picture are merged into the sky, and the dark shadows possess an unnatural degree of detail, it is safe to conclude that the exposure has been too much prolonged. But if, on the contrary, the shadows are altogether dark and quite wanting in detail, while the transition from the highest light to the deepest shade is made, as it were, by a jump, instead of through a delicate series of intermediary tones, the exposure has been too short.

But in developing it is possible to obviate to a large extent the effect of either over- or under-exposure. If, when the image appears, it is judged to have received too great an exposure, immediately pour off the developer, and apply one in which the silver intensifier will predominate in its composition to a greater extent than the one or two drops recommended. This will impart force and vigor to the details only feebly brought out by the application of the pyrogallic acid developer. If it be borne in mind that the pyrogallic acid brings out the image, and the silver strengthens it, it will at once be perceived that by adjusting the parts which each has to play, the skillful operator is in command of the position. But if, on the other hand, the appearance of the image warrant the supposition that it has received too short an exposure in the camera, it will be necessary that the plate receive the fullest possible application of the developer, so as to enable everything that *can* be brought out to *be* brought out. The patience of an angler after a fish is nothing to that displayed by some of the most eminent amateurs when they have found that by under-exposure or by the deep contrasts in their picture a prolonged and sure development would be necessary. The method adopted under such circumstances by a very skillful amateur, whose name is well known among the world's ablest artists, was to light a cigar and by its aid and that of a newspaper to wait and watch patiently till all the details appeared, aiding this by warmth if necessary. The great object in a case of this nature is to promote development and suppress intensity. There is frequently a high de-

gree of fascination in coaxing out an obdurate picture. The method of development here described is that known as "*acid pyro.* development," in contradistinction to "*alkaline pyro.* development," which latter permits of a briefer exposure being given than when the slow and sure method now described is adopted.

Alkaline Development.—By this method of development, a shorter exposure may be given than when acid development is employed. It consists in rendering the pyrogallic acid solution alkaline by the addition of ammonia or carbonate of soda. While it is almost mainly employed in the development of emulsion plates, it is also a great power to have at hand in the case of slow bath plates. The alkali having a tendency to produce fog in the shadows, a small portion of bromide, such as that of potassium, is added, by which that tendency is entirely obviated. Not only so, but as this bromide possesses the power of undoing the action of the light upon the plate in such a degree as to entirely obliterate the latent image if used too strong, it will be seen that its strength may be so adjusted as to enable it to check the effects arising from over-exposure in the camera. For this reason if a negative, upon the image first making its appearance, show unmistakable indications of flatness arising from over-exposure, a dash of a few drops of a weak solution of bromide, either thrown over the plate itself or into the developer, will instantly prevent the development of any further details, and thus enable what *has* been brought out to receive its full amount of intensity.

The changes that may be and have been rung upon the ingredients and proportions of the alkaline developer are innumerable; at this place we shall present only one formula:

Pyrogallic acid, - - - - -	3 grains.
Water, - - - - - - -	1 ounce.

To every half ounce of the above add, when just ready to develop, two drops of a ten-grain solution of bromide of potassium and three drops of a thirty-grain solution of carbonate of ammonia. When this is applied to the plate the image appears with great rapidity and moderate vigor. Should, how-

ever, it be tardy in coming up, from under-exposure, a drop or two more of the ammonia solution will accelerate its action; but if, on the contrary, there are evidences of the exposure having been too great, more of the bromide must be added.

Intensifying the Image.—It sometimes happens that the image, no matter by what means developed, is too feeble to yield a bright and vigorous print, and stands in need of further intensification. While there are various excellent ways of imparting such intensity to a negative—all of which will be fully treated of in a subsequent chapter—it will answer every purpose at present if we show by what means intensity may be imparted as part and parcel of the act of development.

Provide a solution composed of three grains of pyrogallic acid to the ounce of water, together with a solution (kept in a second bottle) of three grains of citric acid and ten grains of nitrate of silver to the ounce of water. The image that is to be intensified having been first washed so as to insure the removal of all ammonia, should be flowed over with the pyrogallic solution, to which has been added a few drops of the mixed citric and silver solutions, by which it will rapidly acquire any degree of intensity that is desired. The only precaution to be observed is to avoid making it too dense. It is often a wise precaution to insure the neutralization of any traces of alkali in the film by first flowing it over with a weak solution of citric acid (precise strength immaterial) before applying the pyrogallic and citric intensifier.

The fixing of the image may be effected either by a ten-grain solution of cyanide of potassium or a saturated solution of hyposulphite of soda. Let the plate be thoroughly washed after fixing. After being dried it must next be varnished.

Varnishing.—Owing to the delicacy of the collodion film that contains the image, it is necessary to protect it by a strong and tough varnish.

The requisites for a good negative varnish are that it dries hard without being brittle, penetrates and adheres closely to the collodion film, expands by heat in the same ratio as the collodion, and under no circumstance becomes tacky, even when

exposed to a hot sun. Varnish possessing these qualities is now easily and cheaply obtained in commerce, and it is scarcely advisable in any to make it for themselves. Still, for those who prefer making their varnish, and there are many such, we give some directions by which it can be made in the certainty of a good and reliable article being produced.

One of the most popular "home made" varnishes in use at the present time consists of

Sandarac,	1 ounce.
Castor Oil,	80 grains.
Alcohol,	6 ounces.

The sandarac must first be dissolved, the oil being then added.

In this formula it may be observed that the sandarac and alcohol alone make a varnish that is bright and hard, but without such modifying influence as that imparted by the castor oil it would be too brittle. Moreover, the oil also imparts a peculiar kind of "tooth" to the film, by which it is enabled to take the touch of a pencil, and thus save the trouble and risk of grinding the surface when the picture is to be retouched.

Bleached lac dissolved in alcohol forms a good varnish; but, while it is not better than the above, it is more difficult and tedious to prepare.

A good negative varnish, extensively sold under various names, consists of

Sandarac,	2 ounces.
Seed lac,	1 ounce.
Castor oil,	3 drams.
Oil of lavender,	½ dram.
Alcohol,	18 ounces.

In applying any of these varnishes the negative must first be gently warmed to such a degree as to permit of the back of the hand being pressed against it without any discomfort being experienced. It is then held in a level position, and the varnish applied in the same way as the collodion.

Recapitulation of the Foregoing.—The process that has now been described is that of producing a dry plate negative by the bath process, and we conclude by giving a recapitu-

lation of the manipulations necessary. The plate having been cleaned receives a substratum to prevent the film from slipping in after operations; it is then collodionized and sensitized in the silver bath. This is followed by washing and the application of a preservative, after which, when dried, the plate is stored away ready for use at any time. It is next exposed in the camera, developed as soon afterward as convenient, fixed, washed and varnished.

It is proper also to state here that the foregoing method of preparing and manipulating dry plates, while it has produced numerous exquisite pictures and is always to be relied upon, is at the present time looked askance at by the majority of experienced photographers, who are fascinated by the greater simplicity of *emulsion* photography, by which a silver bath is dispensed with. But in photographic processes fashions surge, rising and falling like the tide, and it is not improbable that the process just described, and upon which the greatest reliance may always be placed, may soon receive large accesions to the numbers who after trying others prefer to adhere to it on account of its certainty.

CHAPTER V.

EMULSION PHOTOGRAPHY—COLLODION EMULSION.

In emulsion processes no silver bath is employed, the sensitive material being mixed up with the collodion as an emulsion. The advantage of this is that by the one operation of coating the plate all the others, especially that of immersing for several minutes in the silver bath, are obviated. In its most simplified form the emulsion is poured upon the plate and terminates the whole preparation.

In negative emulsions the sensitive material is bromide of silver, and the medium by which it is applied to the plate is either collodion or gelatine, whence arise the terms *collodion emulsion* or *gelatine emulsion*. These will be considered seriatim.

To Prepare Collodion Emulsion.—To five ounces of plain collodion, composed of eight grains of soluble cotton, five drams of ether, and three drams of alcohol, add eighty grains of bromide of zinc previously dissolved in one ounce of alcohol, and also add twenty drops of syrupy lactate of ammonia. Now, in a test tube, place a hundred and fifty grains of nitrate of silver with a little over a dram of water; apply heat to dissolve it, and then add three ounces of alcohol, and, having raised the heat to near the boiling point, pour it by slow degrees, and with constant agitation, into the collodion—doing this, of course, in a darkened room. Keep it in a warm place and shake well at frequent intervals. After at least one day add twenty drops of nitric acid, shake well again, and pour out in a large and flat dish to set. When it has become partially solid, break up the film with an ivory or silver knife or a slip of glass, and then fill the dish with water, which should be changed several times, and by which the soluble salts are removed. After the last washing, the pellicle or partially dried film is allowed to dry throughout, after which it is dissolved in a mixture of five ounces of ether and five ounces of strong alcohol. This emulsion keeps for a long time and produces pictures of a high class.

To use the emulsion it is only necessary to pour it over the glass plate in the manner already described, and then allow the film to dry, when it is ready for use.

At a recent photographic exhibition in Europe, the pictures which were most loudly praised were prepared in the manner described, although some of them were subjected to a further piece of manipulation. After the collodion film had set the plate was immersed in a dish of water, and afterward treated with the whites of eggs beat up with a few drops of acetic acid which had been added. To each ounce of this albumen was added twice its volume of water containing a dram of ammonia.

In the preparation of plates by such an emulsion as that just described, when the operation is completed the plates are finished and are placed away for future requirements. A supply of such plates may be taken on a voyage around the world in the confidence that each one will yield a good negative.

Another method consists in adding to seven and a half ounces of plain collodion two hundred grains of bromide of zinc. It is not added all at once, but as follows: One hundred grains are dissolved in the smallest possible quantity of alcohol, after which it is mixed with the collodion. The remaining hundred grains are dissolved in a similar manner. This is kept n a test tube. Next, dissolve in another test tube, by the aid of heat, three hundred and thirty grains of powdered nitrate of silver in five drams of water. In a third test tube boil one and a half ounces of alcohol and pour it upon the dissolved silver, and mix them thoroughly. This is now slowly poured into the collodion, with constant stirring by a glass rod. When about three-fourths have been added, pour in the bromide solution by slow degrees and with constant agitation, after which the remainder of the silver is added.

The bottle containing the above should now be allowed to remain undisturbed for about twenty-four hours, after which it is poured out into a flat dish, and, when set, broken up in the manner already described, and washed for two or three hours with plain water, after which it is treated for four hours with water containing one per cent of muriatic acid. After a final washing in plain water, the pellicle is freed from all excess of water by being placed in folds of linen and subjected to the action of a screw press, when it is placed in alcohol, once more pressed in the linen, and dried. It is, at any convenient time, dissolved in twelve ounces of ether and eight ounces of alcohol, when it is ready to be used in the preparation of plates.

After the glass plates have been cleaned, it is desirable that the surface should be dusted over with powdered French chalk, and then well rubbed. This, as already explained, causes a strong adhesion of the collodion film which might otherwise be disturbed and removed from the plates during the subsequent operations.

To Develop an Emulsion Plate.—The method described for developing tannin or coffee plates by the acid pyro. developer is not suitable in the case of emulsion plates. One or other of the following methods may be adopted, and we find it difficult to recommend any of them as being better than

another, although to the beginner some may be found more convenient.

No. 1.—Alkaline Pyro. Developer.

A.	Pyrogallic acid,	3 grains.
	Water,	1 ounce.
B.	Bromide of potassium,	10 grains.
	Water,	1 ounce.
C.	Carbonate of ammonia,	30 grains.
	Water,	1 ounce.

To every half ounce of A add two drops of B and three drops of C.

No. 2.—Ferrous Oxalate Developer.

In a warm saturated solution of neutral oxalate of potash dissolve ferrous oxalate to saturation.

A more convenient method of preparing this developer consists in adding to the solution of oxalate of potash from fifteen to twenty grains of powdered protosulphate of iron to each ounce of solution. Details concerning ferrous oxalate development will be found at page 38.

No. 3.—Ferrocyanide Development.

Ferrocyanide of potassium,	4 ounces.
Sal soda,	6 drams.
Bromide of ammonium,	25 grains.
Water,	16 ounces.

Pour into a measure the quantity of this that is required to cover a plate, and then add a pinch (comprising two or three grains) of dry pyrogallic acid.

Of these various developers many prefer No. 1, on account of the control it affords over the quality of the image. For example, if there is reason to believe that the plate has not received sufficient exposure in the camera, the proportion of B may be diminished and that of C increased. On the other hand, if the exposure has been too long, the effects may be obviated by increasing B and making very sparing use of C. From this it will be seen that B is a powerful restrainer.

No. 2 is employed more extensively for plates prepared with gelatine than with collodion emulsion. An advantage connected with its use lies in the advisability of its being employed in a

bath, into which the plate is immersed and allowed to remain till developed.

No. 3 is, by many, preferred to the others, on account of its uniformity of action. It yields very clean negatives, possessing fine gradation. In case of under-exposure a few drops of

Bromide of ammonium, - -	40 grains.
Ammonia, - - - - - -	1 ounce.
Water, - - - - - -	1 ounce.

added to the above ferrocyanide developer will prove beneficial. These various developers are designated respectively, the alkaline pyro., the ferrous oxalate, and the ferrocyanide developers.

If, after development, the image be found too thin and feeble to produce vigorous prints, it may be intensified by means of the pyrogallic, citric acid, and silver solution described in connection with the development of tannin plates. Wash the plate thoroughly, and then apply the pyrogallic acid solution, taking care that too much silver be not added in case of the picture becoming too intense.

When the negative is found to be satisfactory, after fixing in hyposulphite of soda, wash thoroughly, dry by a gentle heat, protect it by a coating of the negative varnish previously described, applied in the manner already directed in the preceding chapter. Unless the plate is well warmed the varnish will chill instead of drying bright and clear.

CHAPTER VI.

GELATINE EMULSION.

When gelatine is made use of instead of collodion as a vehicle for holding the sensitive atoms of bromide of silver, it is found to possess an exalted degree of sensitiveness. This renders gelatine emulsion the best medium with which to coat plates for securing instantaneous effects, or for taking portraits of children in dull weather. With gelatine plates pictorial effects may be obtained which could not be secured by even the most sensitive collodion process.

The emulsion may be prepared in the following manner:

Place in a clean pint bottle forty-five grains of bromide of ammonium, four ounces of distilled water, and ninety grains of gelatine. Shake up to insure the solution of the bromide, and allow to stand for an hour. In a second small bottle or test tube dissolve seventy-five grains of nitrate of silver in an ounce of distilled water, and then place both bottles in water warmed up to 100 deg. Fahr., by which the now swollen gelatine will be liquefied. Both are now taken into the dark room and the silver poured slowly into the gelatine with constant agitation. The above heat should be retained for six hours, so as to insure perfect emulsification.

To remove the soluble and useless salts from the emulsion, it is poured out into a flat dish and allowed to set, after which cold water is added for the purpose of dissolving out these salts. This washing is facilitated by breaking up the pellicle with a paper knife. Let this washing be thoroughly done, and take plenty of time to do it. When completed, drain off all the water, place the pellicle in a bottle, again heat to 100 deg. Fahr., and the emulsion will be liquefied, when, after being strained through fine calico, it is ready for use.

From these simple directions certain departures may be made with advantage. For example, instead of the temperature of 100 deg. Fahr., at which the heat is kept after the silver and gelatine are united, it may be raised sixty or eighty degrees higher with marked benefit, greatly increased sensitiveness being the result, together with a shortening of the time required for emulsification. Some even prefer bringing one half, or at any rate a large proportion, of the newly formed emulsion up to the boiling point, this, when allowed to cool down to a little over 100 degrees, being then added to the remainder.

Another Process, with Full Details.—The following is a detailed account of a process by which we have prepared many plates possessing great sensitiveness. We first weigh out

Bromide of ammonium, - -	100 grains.
Nelson's gelatine, - - - -	40 "

These, together with one and a half ounces of water, are placed in a thin bottle capable of holding a pint. Simul-

taneous with this, half an ounce of gelatine and three ounces of water are placed in a pint beaker; while into a test tube of suitable dimensions are placed 165 grains of nitrate of silver with one and a half ounces of water.

In about a quarter of an hour the gelatine is found to have become swollen from its absorption of water, and we are now ready to make the sensitive emulsion. During the fifteen minutes that we have been waiting for the gelatine to swell we have had a saucepan of water on the stove, and it is now boiling; and in this water we immerse the bottle containing the gelatine and bromide. The bottle, being thin, does not crack by this treatment, as it would do if the glass were thick. When a *thick* bottle is employed for this purpose it is indispensable that it be warmed up gradually by being placed first in lukewarm water for a couple of minutes, then in water still warmer, before its final transference to the boiling saucepan.

To the gelatine, which is now liquefied, is next added the nitrate of silver in the test tube; but, previous to doing so, certain precautions have to be adopted, most important of all being the turning out of the gas and the substitution of a feeble light in a lantern fitted with a deep ruby glass. In all subsequent operations it is of vital importance that not the faintest trace of white light be admitted into the room in which is kept either the emulsion or the plates after being prepared. A collodion operator must quite divest himself of the idea that he can handle gelatine emulsion in such a light as that by which he can with impunity manipulate wet collodion; and the sooner he thoroughly realizes this the sooner will he attain to success in gelatine work. Failures may almost invariably be attributed to the fact that the operator does not adequately appreciate the extraordinary sensitiveness of bromide of silver when emulsified with gelatine.

Allowing the saucepan to continue its boiling, we lift out from it the bottle containing the gelatine, and add to it, by little and little at a time, the nitrate of silver solution from the test tube. The *first portion* of this solution is not, however, poured direct from the quantity in the test tube, but from a small measure into which it has previously been poured, and

to which an equal bulk of water has been added to dilute it. The precise quantity of the silver thus diluted for the first addition is immaterial—it may be about a sixth or an eighth of the whole without making any difference in the finished emulsion. After the first addition of silver insert the stopper into the bottle and shake it vigorously for half a minute, then replace the bottle into the saucepan for about a minute, after which add the remainder of the silver in four doses, stoppering the bottle and shaking it well after each addition.

If the bottle have a glass stopper, insert a bit of thread in the neck so as to prevent it from fitting too tightly, replace in the boiling water, and allow it to remain there for three quarters of an hour. It is now removed and cooled down rapidly to such a degree as to be capable of being grasped by the hand without a feeling of discomfort—that is to say, the temperature will be about 100 to 110 deg. Fahr.—at which stage the remainder of the gelatine—viz., that which was placed in the beaker, and which has been liquefied by setting it in warm water—is added. This gelatine must have been liquefied at the lowest degree of heat consistent with bringing about its dissolution; and the way we mix it with that which has previously been boiled is by pouring it from the beaker into the bottle, shaking well up for a short time, and then pouring back into the beaker again, drawing every drop possible from the bottle, which, as we shall not have occasion to use again, is rinsed with hot water and put away. We now incase the beaker with its emulsion in a tin or other light-proof box, and place in a cold place to solidify, where it may be allowed to remain for twenty-four hours, or till the next evening.

The emulsion is next washed to free it from the crystallizable salt—the nitrate of ammonia—which was formed as one result of the mixing of the bromide of ammonium with the nitrate of silver. The quickest way of doing so is to cut the solid mass of jelly out of the beaker by a paper knife, place it in a piece of open-meshed canvas twelve to fourteen inches square (the fabric we employ for this purpose is manufactured for wool-work requirements), then twist the neck and plunge into a basin of iced water. Grasping this neck firmly with

the left hand, the side of the right hand, or closed fist, is now pressed down upon it so heavily as to force the emulsified gelatine out through the meshes of the fabric, and thus break it up or divide it in a manner more completely than could be done in any other way. If the hands be at all warm, it is well to cool them by immersion in cold water just previous to engaging in the operation now described. After allowing the broken up emulsion to remain in the water for about a quarter of an hour, the water is poured away as completely as it can conveniently be done, then the remainder of the water with the emulsion is poured into the beaker, over the mouth of which the canvas cloth is then tightly stretched, and the water drained off as thoroughly as possible. The emulsion is again transferred to the basin, which contains clean, and still *cold*, water, and allowed to remain an hour. A third washing under similar circumstances usually suffices to effect the removal of all the soluble salts. In a description of the process for which a committee of the Photographic Society of Great Britain awarded a prize of fifty pounds, given by a wealthy amateur, and which is substantially as here given, it is recommended that the first washing water contain bichromate of potash to the extent of an ounce of a saturated solution to each pint of water so employed, the object of this being to undo the consequences of any light that may have fallen upon the emulsion during preparation.

After the emulsion is washed it is gathered together into the beaker, drained thoroughly, and liquefied by as low a heat as convenient, half an ounce of alcohol being then added, and enough warm water to make up to ten ounces. Having been filtered through two thicknesses of fine muslin, the plates, previously cleaned and placed on a level table, are now coated.

The best vessel from which to coat plates is, in our estimation, a toy porcelain coffee pot, into the interior aperture of the spout of which has been loosely placed a plug of cotton wool.

The plates, after being coated, must be kept in the level position until the film has set sufficiently to enable them to be reared on end to become thoroughly dry.

A Third Modified Process.—Were we to give one-

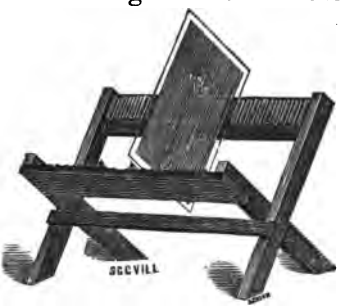
tenth of the formulas that have been successfully employed by able photographers in making gelatine emulsion, this book would have to be enlarged to more than double its dimensions. We shall, therefore, confine ourselves to giving only one more, which is strongly recommended on account of its certainty. It might be said, If one formula is good and reliable, wherein lies the necessity of cumbering a beginner by giving any others? The object is to indicate the latitude that is allowable in carrying out a principle, all the methods given being nearly equally good, and yet each possessing a slight difference from the other.

Put into a small graduate one ounce and six drams of water, and into a four-ounce wide mouth bottle forty grains of gelatine, fourteen grains of bromide of ammonium, and one ounce of water from the graduate. After twenty minutes place the bottle in warm water to liquefy the gelatine. Place in a test tube twenty-two grains of nitrate of silver with half an ounce of the water remaining, and dissolve over a spirit lamp, mixing by shaking or stirring with a small glass rod. Of this pour about a quarter into the gelatine (in the darkened room, of course), and follow by agitating the bottle containing it. Repeat this two or three times, until all the silver is added, and with the remaining two drams of water rinse out the test tube and add the water to the gelatine. The emulsion must now be allowed to stand for four or five hours in a vessel of water heated to 110 degrees, after which it is allowed to cool very gradually. When the emulsion has set to a sufficient degree of stiffness the crystallizable salts are removed by washing, ice water being used if the weather be too warm. This washing may take place during the night, and in the morning the water is poured away and the emulsion liquefied by placing the bottle in warm water. After adding two drams of alcohol, and filtering through cotton wool, the emulsion is ready.

Coating Plates.—In coating plates with gelatine great uniformity is secured by dipping into the warm emulsion a vessel of such dimensions as will hold enough to coat one plate. A tobacco pipe formed of clay or wood forms one of the best spoons or ladles for such a purpose. By one or two

trials the proper size of such a vessel will be ascertained. For coating 5 x 8 plates it should contain about two drams, a 4 x 5 plate requiring only half this quantity.

When the plates to be coated are of large dimensions, it is advantageous to employ a pneumatic holder to sustain them during this operation; but, when they are small in size, this may be dispensed with. Previous to commencing to coat plates, they should all be placed before the operator in a rack such as the portable folding one shown in the adjoining diagram, or be piled up one against another, the faces all being one way. This must be seen to before commencing to coat them, during which operation the light present will be too feeble to enable one side of a plate to be compared with another.



Grasping a plate, if a small one—say under eight inches—by the corner, the gelatine emulsion is poured in a pool on the center, and then spread equally and nicely over the entire surface. Collodion flows with an oily smoothness over a plate; gelatine is different in this respect, and any attempt to make it flow by tilting the plate would insure its running in a stream to the edge and flowing over. A stiff slip of card-board, a flat slab of ivory, a glass rod, or even a clean finger, form the means by which the emulsion may be guided all over the surface of a plate. A board, bench, or table, previously made quite level, must form the most important article of furniture in the coating-room at this juncture, and upon it must be laid down carefully the plate just coated. What is required in this table is that it shall be as cold as possible, by being placed in a cold part of the room or by any other contrivance. Coldness favors the rapid setting of the gelatine on the glass, and when once it has set the plate may be transferred to the shelves of a drying box, in which a perfect level is of no consequence, for when once a gelatine film sets or jellifies on a plate it will not again liquefy during its drying, unless, of course, it was exposed to a far higher degree of temperature than is at all likely to be the case.

In a drying box there must be provision for a constant current of cool air, which, passing over the surfaces of the plates, shall deprive the gelatine of its moisture with a reasonable degree of rapidity. The principle upon which a drying box may be constructed consists in arranging the plates in a light-tight box so as to expose them to an upward current of air which is supplied from apertures near the bottom, and which is drawn upward by a kerosene lamp placed on the top, and so arranged as to draw its whole supply of air from an aperture in the top of the drying box. From this it is apparent that no sooner is the lamp lighted and placed in position than it draws upward through the box the large volume of air which is necessary to combustion. The drying of the plates, when a contrivance of this kind is made use of, may thus take place during the daytime, even in a well lighted room.

Storing Gelatine Plates.—When quite dry pile the plates, one on top of the other, in packages containing half a dozen or one dozen each. Previous to doing so, provide a supply of sheets of white tissue paper cut neatly to the size of the plates. Then arrange the plates face down, taking care to insert a sheet of the paper between each. The package is then wrapped up in thin tough orange colored paper, followed by a similar wrapping in black paper. This is then placed in a box or case of stout card-board, which must fit the package of plates in such a way that they can easily be removed. The cases thus charged with plates are finally placed in a paper envelope, labeled, and placed away till wanted for use. If these precautions have been taken, the plates may accompany a tourist twice round the world and be quite as good afterward as when freshly put up.

To Develop Gelatine Plates.—Although any of the developers described on page 30 will answer for gelatine as well as collodion emulsion plates, we recommend the following as being safer and easier, especially for a beginner, than anything else.

Provide two stock bottles of any dimensions exceeding a few pints' capacity. As the solutions that are to be kept in them

remain good for a long time, it saves trouble to make at least two or three pints at a time. In one of them dissolve

Solution 1.	Bromide of ammonium, -	30 grains.
	Neutral oxalate of potash,	5 ounces.
	Water, - - - - -	20 "
Solution 2.	Tartaric acid, - -	20 grains.
	Protosulphate of iron, -	5 ounces.
	Water, - - -	20 "

Having determined upon the quantity of liquid that it will be necessary to pour into the developing tray or pan to cover a plate properly, pour into a glass graduate the above solutions in the proportion of

Solution 1, - - - - - -	4 parts.
Solution 2, - - - - - - -	1 part.

And then pour this mixture into the developing tray.

To afford an idea as to quantities, we find that two ounces of solution 1 and half an ounce of 2 form a sufficient quantity for developing 4 x 5 inch plates. The mixture should be made just when about commencing. The operating room being darkened, and no light present but the red light from the lantern, the plate is removed from the dark slide and placed, face up, in the solution. Holding the tray up in the hand, let the solution be made to pass in waves over the plate, and after a few seconds commence to keep a sharp lookout for the picture. Very soon the sky line will become visible, followed by the more prominent objects in the picture. The developing will now proceed with great rapidity; and when, in the estimation of the operator, the whole of the details are visible it is necessary to remove the plate from the solution, hold it up against the light and examine to see if everything is out and the intensity sufficient for printing. Should this not be the case, return it to the solution, and allow it to remain until it acquires the properties desired. Then remove it, rinse with cold water, and pour upon the surface a saturated, or at any rate a *strong*, solution of hyposulphite of soda in water, by which the milky-like layer of bromide of silver is dissolved away and the picture left clear. This operation of "fixing"

must be followed by copious washing, in order to remove the fixing solution from the pores of the gelatine.

Instead of transferring the plate direct from the holder to the developer, it is sometimes desirable to place it first in water for a quarter of a minute or more. This enables the developer to penetrate the film quicker than when the plate is placed direct in the developer.

If the plate during development show unmistakable indications of being over-exposed, instantly add to the developer a few drops of a ten-grain solution of bromide of ammonium (or potassium), which, as explained on page 29, is a powerful restrainer. In the ferrous oxalate developer made as above several negatives may be developed. It may be necessary to strengthen it occasionally by adding a few drops of the number 2 solution.

The most convenient manner in which to keep and apply a ferrous oxalate developer is by means of a bottle having an opening at the bottom. To this opening is fitted, by means of a projecting spout, a short length of rubber tubing, the loose end of which, when not in use, is placed in the mouth of the bottle. Having been nearly filled with a supply of the developer mixed ready for use, a little refined kerosene or other oil is poured in and forms a supernatant layer to the depth of half an inch, by which the atmospheric air, which destroys the developer, is kept away from it. When a plate is to be developed, a dish or pan is held below the spout, and the rubber tube being brought from the mouth down below the level of the liquid, the developer runs out into the pan. By raising the pipe above the level of the liquid, the flow ceases. When done with, the developer is poured back into the bottle. By these means a ferrous oxalate developer will keep good for several months.

CHAPTER VII.

PRINTING POSITIVES ON ALBUMENIZED PAPER.

THE principle on which photographic printing is conducted is this: A sheet of paper washed over with nitrate of silver, and then dried, will darken upon being exposed to a strong light. But if, previous to placing it in the sunlight, it be covered by a negative in which, as is implied by the name, the whites in nature are black when looked through, the exact counterpart of the negative will be produced in positive form, the opaque sky of a landscape or the white shirt breast of a human figure forming a barrier through which the light cannot pass to the sensitive paper, which consequently remains white in parts. Hence the term "positive," in contradistinction to the "negative," from which it was obtained.

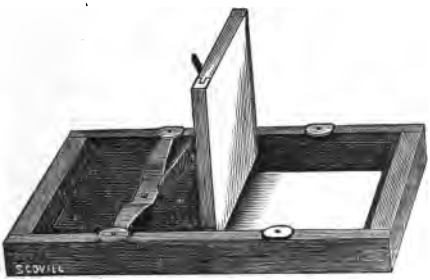
Albumenized paper, so named from its being heavily sized with albumen containing a certain proportion of salt, is almost exclusively used in photographic printing. The function of the albumen is to keep the image on the surface of the paper, and thus impart brilliance to the picture. This albumenized paper is obtained from the dealers so much cheaper and better than it can be made by the private consumer, that no one now thinks of preparing it for himself.

To sensitize the paper, allow it to float, face downward, on a solution of nitrate of silver of the strength of from forty to sixty grains to the ounce of water. This solution having been poured into a flat dish, the sheet of paper to be sensitized is taken by the opposite corners and bent in a curved form; the center is then lowered down upon the solution, and the corners are then also opened out and laid down. Breathing upon the back usually assists a corner with an inveterate curl to lie flat down. There is thus secured an entire freedom from air bubbles. Three or four minutes is an average time for the sheet to remain in contact with the solution; but this varies according to the nature of the paper. The sheet is then raised from the solution, the surplus solution on the surface removed by

drawing it over the straight edge of the sensitizing dish or over a glass rod, and then hung up to dry, either over a wooden rod, or, preferably, by wooden spring clips such as are used for drying clothes. A quick heat in drying is best, and for the first essays of the amateur this drying may be effected before a clear fire. The paper, although sensitive, is not so in such a degree as to prevent its being worked with in a rather dimly lighted room.

The paper is now sensitive to light, and may be printed upon without further delay or preparation; but it is found that a better quality of picture, together with a greater degree of sensitiveness, is produced by subjecting it for a few minutes to the fumes of ammonia. This is done by suspending the paper from the roof of a cupboard, (even a good packing case will answer), on the bottom of which is placed a dish containing liquor ammonia. Ten minutes is a suitable time in which to expose the paper to the ammonia; if carried too far the tones of the finished prints will exhibit a lack of vigor. Instead of fuming the paper in the manner described, the same effects may be obtained by placing behind the paper when in the printing frame a cloth pad previously well charged with the vapor of ammonia.

All printing frames are arranged so as to enable the progress of the printing to be watched at intervals. The drawing shows



the construction of a printing frame of the kind most commonly used. It is necessary to carry this operation to a much further extent than the mere bringing out of the details of the picture, for the printing must be *overdone*—that is to say, the operation must be continued till the print is much darker than it is desirable it should ultimately be. The reason for this is, that in the toning and fixing processes to which the print is afterward subjected, the image becomes much lighter as regards the extent to which the printing has been carried. Much of it becomes, in a sense, washed out.

Unless under special circumstances, it is better to print by the diffused light of the sky rather than by the direct rays of the sun. But if a sheet of tissue paper or a plate of ground glass be placed in front of the printing frame, the direct sunlight is softened to such a degree as to enable the printing to be carried on in the sun.

Vignette Printing.—If it be desired to print a photograph, whether a portrait or landscape, as a vignette, it is only necessary that the light should be admitted to the central portion of the picture, and be allowed to fall away toward the margin. Many devices for effecting this have been adopted, but that which is most commonly employed consists in placing at a short distance in front of the negative a sheet of opaque paper or thin card-board, having an aperture cut into it of a form and size approximating to that of the head and bust of the figure on the negative. This aperture in the vignetting mask should be covered by thin white tissue paper, and the mask itself should be mounted at a distance in front of the negative determined by the kind of effect that is wanted. If the distance from the negative be only half an inch, the vignetting of the finished picture will be too hard, the transition from the fully printed portion to the white ground surrounding the figure being too abrupt for pictorial effect. By increasing the distance to an inch, or even much more than an inch, in the case of a large picture, a better effect is obtained; the figure then merges imperceptibly into nothingness. The necessity for covering the mask with tissue paper does not exist when care is taken to print the vignette by a diffused light from an even sky, and to change the position of the printing frame so as to insure equality throughout.

Medallion Printing.—Another style of printing is much adopted, usually known as medallion printing. It consists in interposing between the negative and the sensitive paper a sheet of thin black paper having in it an oval aperture. These black masks, or "cut outs," are sold in assorted sizes by the stock dealers, and out of one packet may be selected one or more sizes that will suit every requirement. By

the use of these the printing is confined to a perfect oval, the surrounding paper being pure white. But to the ground may be imparted any desired tint, from a faint blush to perfect blackness, by selecting the center piece that corresponds with the mask used, and which is always sold along with it, pasting it lightly to a plate of glass, and laying it carefully over the picture, now removed from the printing frame and laid on a small flat padded board. This protects the already printed picture from the light, leaving no portion exposed except the plain ground. An exposure to light from two or three seconds upward, according to depth of tint wanted, is now given. Good effects may be produced in some cases by judiciously placing the central mark a *little* to one side, instead of directly covering the printed portion by it. This leaves a white shaded line at one side, which is sometimes very effective. But flights of this kind are not recommended to be indulged in until the amateur feels that he has mastered printing of a plainer kind. Hints concerning those higher essays into artistic printing, and printing one photograph from two or more negatives, will be found on another page.

Trimming the Prints.—As the prints are removed from the printing frame they are placed in a drawer to protect them from the light. When all are done they are trimmed by being cut to the dimensions required. Squares of thick plate glass having polished edges are provided for this purpose, and are used, to the exclusion of all other methods, by professional photographers. But an amateur, especially at the commencement of his career, may adopt such methods as his own common sense dictates as convenient in his own case. For example, he may lay the print down on a plate of glass (which is so much better than anything else for the purpose), and by aid of a flat rule and a sharp knife he may trim his picture as he likes, quite irrespective of what are termed regular sizes; or he may use a "regulation" glass shape placed carefully over the picture, instead of the flat rule first mentioned, and use its sides as the guide by which to direct the edge of his knife; or he may place the guide over the picture, and, by means of a pair of scissors

having long blades, he may trim the print by their aid. If the amateur has familiarized himself with such methods, and at an after stage of his life history he is afforded the privilege of being admitted into the printing room of any large photographer, he will be perhaps somewhat surprised to discover that he already knows all about it, so far, at any rate, as mere knowledge is concerned. He must never, however, forget that in regard to manipulative perfection he cannot hope to attain the mechanical skill achieved by, it may be, a boy or girl of very mediocre abilities in other directions, but whose aptness in this or any similar department of manipulation has been sharpened by practice. Here is a bit of philosophy for the young and intelligent amateur: A machine which is the product of thought can be made to do work much better and far cheaper than the man by whom the machine was invented and made. The man ought not, therefore, to hope to compete in these points with his machine. In like manner, the amateur photographer must not hope to compete in mechanical excellence with those whose labors are pointed in one single direction only, although, as a matter of historical fact, *some* amateurs have far surpassed them.

When trimmed, the prints are placed in a vessel of water. This removes from them the superfluous nitrate of silver—that is, the silver that was not used in the formation of the print, yet the presence of which was necessary when the print was being made. By reference to the Appendix, it will be seen that all this superfluous silver can be easily recovered. In the meantime, it is enough to say: Keep the water in which the prints have been washed, even to the second and third time, and at some convenient opportunity afterward throw into it a solution of common salt in water. This will produce a great degree of milkiness, caused by the formation of chloride of silver, which, being insoluble in water, eventually subsides to the bottom. When it is considered that chloride of silver contains a very large proportion of pure metallic silver, the importance of preserving it will be appreciated. The manner in which the washings of the prints and all the other "residues" (as they are called) are treated will be found described further on.

After the prints have been washed—the immediate object of doing so being the removal of all the free nitrate of silver—they may at once be placed in a toning bath. But previous to doing so it is found *advantageous*—although, let it be understood, not *necessary*—to place them in a solution by which the traces of nitrate of silver not quite removed by washing are converted into some other salt of silver, such as the chloride or acetate. Some prefer the former, others the latter, on the assumption that it yields a finer quality of tone to the picture. In either case the effect is produced of making the picture a red color, which renders easy the observing of the change of tint it undergoes in the toning bath. An ounce of acetic acid to a gallon of slightly warm water is employed by many as a suitable bath for this purpose. It is almost needless to say that this bath can be used "over and over again." See while in this bath that prints are not allowed to stick together, and allow them to remain for about ten minutes, after which rinse once more until they cease to smell of the acetic acid, and then place them, one at a time, in the toning bath.

At this stage the prints are too red in tone to be pleasing, but in the toning bath they acquire a rich dark color, which not only creates beauty, but causes permanence.

Toning Baths.—Very varied, indeed, is the composition of the toning bath. Those which follow are the best that are known, and the reasons for selecting one in preference to another being given, the amateur will be at no loss to determine which of them is best adapted to meet his own individual case.

Let it be well understood at starting that chloride of gold is the agent by which the change in the tone is produced; and let it be further understood that the phases of tone, rapidity of action, or keeping properties of the toning solution when once it is made, depend upon the nature of the ingredient with which the chloride of gold is mixed. For such purpose *acetate of soda* is used by some, hence originating the term "acetate toning bath." Carbonate of soda is preferred by others, whence the "carbonate toning bath." When chloride of lime is used it is a "lime toning bath," and so forth. This explanation gives the key to understanding the nature of the various

toning baths, which are all composed of chloride of gold mixed with such and such a material.

A favorite toning bath, out of which both reputation and fortune have been made, is the following: Having dissolved chloride of gold in water in any known proportion, such as one grain to one ounce, add to sixteen ounces of water one ounce of the above solution, which will contain a grain of chloride of gold and eight or ten drops of a saturated solution of bicarbonate of soda. This ought to be done only a short time before using the toning bath. A clever way that is adopted by many amateurs when using the carbonate bath is to tear off a small bit of litmus paper (see Appendix) and throw it into the gold solution already diluted with the "*quantum sufficit*" of water, and then adding, by little and little at a time, so much of the carbonate of soda solution as to cause the red color of the litmus paper to be restored to its original blue color. Here, as a mere reminder in general chemistry to those who know all about it, and for the information of the amateur photographer who is picking his steps, we may state that litmus paper is the recognized chemical test for acidity of fluids. When plunged into any solution or liquid containing even a trace of acid the original blue color of the litmus paper is converted into red. A piece of such paper that has been made red by an acid solution becomes blue on immersion into one that is alkaline; and alkaline toning baths are necessary to secure the best results. Ten drops of a saturated solution of bicarbonate of soda, added to sixteen ounces of water containing an ounce of water in which has been dissolved a grain of chloride of gold, makes a toning bath that will leave very little to be desired. This "carbonate bath" must be used within a few hours of the time of its being made, as it decomposes by keeping.

A toning bath which works well for a long time after preparation, but which cannot be used for at least a day after it has been made, is obtained by mixing the following:

Chloride of gold (in solution or otherwise),	1 grain.
Acetate of soda, - - - - - -	30 grains.
Water, - - - - - - - - -	8 ounces.

The tones given by such a bath are rich and warm purples, bordering on sepia when under-toned.

Some photographers prefer a heavy black tone, somewhat akin to that of an engraving. Chloride of lime proves the "friend in need" in such a case. The bath may be prepared in the following proportions:

Chloride of gold, - - - - -	2 grains.
Chloride of lime, - - - - -	6 "
Water, - - - - - - - -	2 pints.

Previous to adding the chloride of gold solution see that its acid is neutralized by the addition of a little common chalk. This bath gives black and white tones like those of an engraving.

When the print is toned, in ascertaining which careful observation is necessary so as not to allow it to proceed too far, it is removed from the toning bath, rinsed in a a vessel of water, and placed in a

Fixing Bath, composed of a solution of hyposulphite of soda. The usual strength is

Hyposulphite of soda, - - - -	1 ounce.
Water, - - - - - - - -	6 ounces.

It is not advisable that this fixing bath be used often. Although it may retain strength sufficient to fix prints after having been used many times, still it is undesirable that it should be used often. The most experienced printers adopt the plan of making a fresh fixing bath each day. To afford some idea as to the number of prints which may be fixed in one bath, we may state that the above solution will answer for thirty or forty prints of the 4 x 5 size, after which it should be poured out into a small barrel or other vessel suitable for preserving the fixing solution, which, by means pointed out on another page, can be made to yield up all the silver it contains.

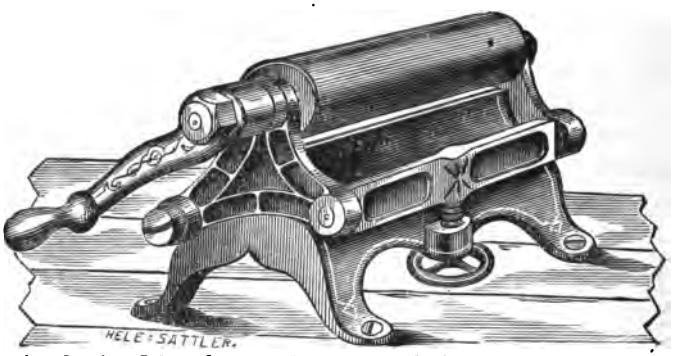
Washing the Prints.—After remaining in the fixing bath for not less than five minutes, and not necessarily more than fifteen, the prints are then washed in plain water to remove every trace of the hyposulphite of soda. Any kind of dish or vessel will answer as a washing trough, provided it holds such a quantity of water as to enable the prints to

float about without sticking to each other. What is required to effect the washing in a proper manner, is the constant ingress of a small stream of water, admitted in such a way as to keep the prints in a state of gentle agitation. A piece of small india rubber tubing attached to the water tap affords a means of doing this.

A rough method of acquiring an idea as to how the washing proceeds consists in applying the tongue to the print. If perfectly washed no taste will be perceived, but otherwise the print will have a saline, sweetish taste. It is not enough to allow the prints to steep for a few hours in the vessel of water—the water must be changed to effect the required end. Hot water is more efficacious than cold, and a few minutes' rinsing with it will suffice to wash the prints; but, except in some special cases, hot water impairs the beauty of the tone.

The mounting of the pictures is accomplished by laying them in a pile, face downward, applying to the back of each stiff, freshly made starch by means of a brush, dexterously lifting it up and placing it on the card mount and rubbing it down by a soft, moist sponge, which absorbs and removes the superfluous starch which may ooze out at the edges. When quite dry a fine surface is given to them by either a hot burnisher or a rolling press.

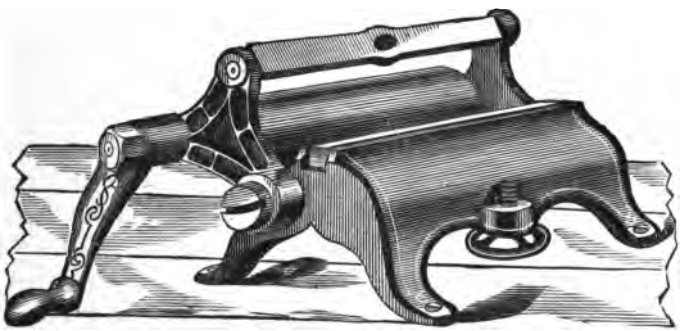
Burnishing Prints.—Owing to the beautiful surface



that is obtained by the employment of the burnisher, the rolling press has been almost entirely discarded, especially for portraiture. As a consequence of this, a high degree of mechan-

ical excellence has been imparted to the print burnisher. It consists essentially of an elongated strip of hard and highly polished steel or other metal, with a slightly roughened roller of the same length mounted so near to the burnishing strip as to be capable, when rotated, of forcing the picture in close contact with the steel and dragging it over it, by which an exquisite polish is imparted.

In the preceding cut a burnisher of the most improved kind is shown, ready for having the picture inserted in the space immediately under the feed roll, the circular-headed screw serving to make the necessary adjustments to permit of cards of every degree of thickness being burnished. In the following cut the feed roll is shown thrown back to permit of a view of the burnishing slip, underneath which is placed a lamp of any kind, either alcohol or gas, to heat the burnisher, by which its finishing powers are rendered energetic. From this drawing it will be seen that the burnishing tool can easily be removed for repolishing or replacing if required.



It is desirable that the prints, previous to being burnished, be lightly sponged over with a lubricant. One of the most popular of these consists of a very weak solution of Castile soap in alcohol, a few grains per ounce.

CHAPTER VIII.

DRIED GELATINE EMULSION PELLICLE.

Between a collodion emulsion and one of gelatine there is this great difference, that the former will remain good for an indefinite period, while the gelatine, owing to its very nature, rapidly deteriorates and becomes putrid. This is a source of great annoyance to the photographer who has just completed the preparation of a large quantity of perhaps surpassing excellence, but greater in quantity than he can possibly use until after it shall have become decomposed and rotten through long keeping, for although in winter gelatine emulsion keeps well for several weeks, in the great heat of summer putrefaction sets in with a rapidity that is appalling.

To prevent this, antiseptics of various kinds, such as creosote, carbolic acid, acetic acid, alcohol, and other preparations have been added to the emulsion, in some cases with marked advantage.

Reasoning on the fact that the presence of moisture is a necessary condition of the existence of putrefactive fermentation, an English experimentalist solved the problem of making gelatine emulsion keep unchanged for years, if necessary, by the simple expedient of pouring it out as a thin sheet upon a slab of glass or metal, and, when set to a sufficient degree of stiffness, removing the pellicle thus formed, exposing it freely to a current of air—in a dark room, of course—and, after being dried, cutting it up into convenient pieces and storing it away for future use.

This method is one of great excellence. The author of this book has in his possession a quantity of dried gelatine pellicle which was prepared in 1877, and which is now quite good. It is put up in little packets, each sufficient to make two ounces of emulsion. All that is required is to place two ounces of water in a thin bottle, add the pellicle, and allow it to remain undisturbed until, by the absorption of water, it has become softened, and then place the bottle in a vessel of

warm water, by which the pellicle is liquefied, the emulsion thus formed being ready for use in the coating of plates.

The following directions will supply all the information needed in the effective preparation of gelatine emulsion pellicle: Take sixteen ounces, or any other known quantity, of emulsion in good working condition, and pour it out into a large flat porcelain dish. Put it in a cool place, and allow it to set to such an extent that, after the edge has been raised by interposing a paper knife between it and the dish, the gelatine is capable of being lifted up as a thin flabby cake. Now transfer this to a thin web of net work or coarse lace, so that the air can have access to it on both sides. When it is nearly dried it may be easily cut into pieces of convenient size by means of a pair of scissors. Let the dimensions of the pieces be so arranged as to render them easily divided into eight portions of equal weight. When *thoroughly* dried these pieces are put in separate packages of absolutely opaque paper and labeled "*Pellicle for two ounces of water.*"

By proceeding in the spirit of the directions here laid down, one may easily, in one evening, prepare enough emulsion to keep him going for many months, resting assured that if converted into pellicle it will not deteriorate by being kept for years. The method here described formed the subject of a patent in England, but it has now expired, and may be adopted everywhere without hindrance.

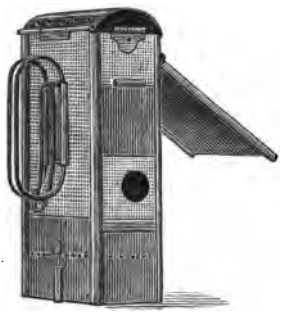
CHAPTER IX.

TOURIST PHOTOGRAPHY IN A HOTEL BEDROOM.

THE title of this chapter is not dictated by whim, but recognizes a condition of very important practical bearing. Many amateur photographers, especially those who enact the role of tourists, have no convenient dark room or laboratory to which they are able to resort when handling sensitive dry plates, either in taking them out of their packages and transferring them to the dark slide of the camera, or in developing them

after exposure. Hence the great importance of making the bedroom of a hotel subservient to these requirements. The author deems it necessary to say that such hints or instructions as he is now about to give arise from an actual acquaintance with the matter, for the present chapter is being written in an ordinary bedroom of a well known New York hotel, and in which he has several times conducted the operations now to be described.

The tourist should have among his baggage a pocket lantern having a ruby glass. The kind we prefer over others is that shown in the cut. Its height is 5 inches, width 2½ inches, and depth 1½ inches. It is a sponge lamp, burning kerosene, and when it is filled it may be packed away among clothes in the certainty of not a drop of the fluid escaping.



Darkness must have set in previous to commencing operations, which we shall suppose consists in unpacking a parcel of sensitive plates and transferring them to the holders or dark slides. Having lighted the lantern and placed it on the table, with the slides lying conveniently at hand, see that the window shutters or shades are closed so as to prevent the ingress of light from the street lamps or other sources of light outside, extinguish the gas or lamps in the room, and then sit for two or three minutes until the eyes become somewhat accustomed to the darkness. Now unpack the plates and transfer them to the slides, taking care to distinguish between the face of the plate and the back, and to insert it the right way. Some makers of dry plates are not sufficiently careful to have all their plates of accurate dimensions, and hence it may happen sometimes that one or two plates may either be too large to be inserted easily in the holder, or may have a projecting corner, which produces the same results. A glazier's diamond, a pair of watchmaker's pliers, or, in the absence of these, a common key having in it a notch of sufficient width, will prove a means for chipping off the offending projection and insuring the plate fitting the holder.

For developing plates *en route*, the ferrous oxalate developer proves very convenient. The various ingredients should be kept in a dry state, and dissolved a short time previous to commencing operations. It facilitates solution if both the oxalate of potash and the protosulphate of iron be kept in a powdered state. But we find the developer which possesses the greatest advantages to consist of the following: Into a quart of water dissolve *dry* sal soda (washing soda) 3½ ounces, and in another bottle dissolve

Oxalic acid, - - - - -	60 grains.
Pyrogallic acid, - - -	64 "
Bromide of ammonium, - -	32 "
Water, - - - - -	1 quart.

When about to be used, mix these two solutions in equal proportions, say three-quarters of an ounce of each for a 5 x 8 plate, which is laid in a dish and the mixture then poured over the surface.

Having obtained from the chambermaid a small jug with a spout, and a slop pail, place the developing tray on the table in front of your chair, seat yourself comfortably, with the jug on your right hand side on the table, the slop pail on the floor at your left, and then adjust the lantern so as to shine into the tray, in which is now poured the developer, the quantity of which should be sufficient to insure the plate being covered. The plate is next gently placed in the tray, and the progress of the development watched. It will be desirable to have spread out upon the table a sheet of an old newspaper to insure against stains from any of the solution dropping, although, if the manipulator be neat-handed and dexterous, not a drop ought to be spilled. After the image appears, raise the plate from the tray by the aid of a pointed match, if there is nothing else handy at the moment, examine the details, and, if they are well out, wash the plate over the slop pail by the water in the small jug on the right. Rear the plate up against the wall, replenish the jug with water from the pitcher, and immediately insert the second plate in the developing tray, the solution in which will suffice for several negatives.

Having treated all the plates in succession alike, and succeeded in developing the negatives, the gas may be lighted and the fixing procedeed with in full light.

After fixing and washing in as thorough a manner as possible, gelatine negatives may be dried and stored away before the operator retires to bed by adopting the following expedient: Have a flat tray made of vulcanite, the same as the developing tray, although in this case one made of tin will answer quite as well, and pour into it enough alcohol to cover a plate when placed therein. The alcohol displaces the water from the pores of the gelatine, and after this treatment the negative is reared up to dry, which it does with great rapidity. As the alcohol gets weaker by the absorption of water from each plate subsequently inserted, it is well, before placing the negative away to dry, to pour a few drops of alcohol from a reserve bottle over the surface so as to drive off the weakened alcohol from the film.

When thus treated, a gelatine negative may be dried before a hot fire without being liquefied.

CHAPTER X.

THE WET COLLODION PROCESS.

This is the process which, up to a recent period, was invariably employed for portraiture, instantaneous outdoor views, and subjects of like nature. Although for such purposes it has, to some extent, been supplanted by gelatine emulsion plates, the wet collodion process is still made use of in eight out of every ten galleries in America.

This process, epitomized in the briefest space, is as follows: A plate is coated with collodion, immersed in a bath of nitrate of silver, exposed in the camera, developed by a solution of sulphate of iron, and fixed with hyposulphite of soda.

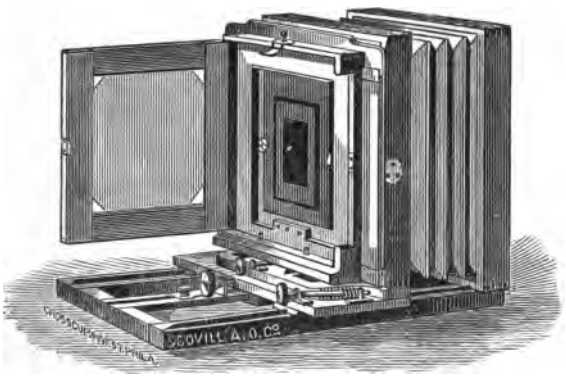
The experience of many years having been brought to bear in such a prominent manner upon wet collodion, this process is now the most certain and reliable of all, the various conditions of success having been so carefully studied.

Negative collodion is the first requisite. This is a solution of certain iodides and bromides in plain collodion, which we need scarcely say is composed of seven grains of gun cotton, or, more correctly, " pyroxiline," dissolved in about half an ounce each of ether and alcohol. In the preparation of negative collodion every maker has his own pet formula. In that which we shall now give—and in this place we only give one —both the nature of the iodizing salts and their relative proportions are such as to yield a collodion of the best quality that can be obtained.

Dissolve

Iodide of cadmium, - - -	65 grains.
" ammonium, - - -	25 "
Bromide of cadmium, - -	19 "
" ammonium, - -	11 "
In Alcohol, - - - - -	5 ounces.

The *reasons* for these proportions we shall not stay to give. The above, when dissolved, is to be added to fifteen ounces of plain collodion containing a greater proportion of ether than alcohol, to allow of both being in nearly equal quantities after



the iodizing solution has been added. Some collodions require to be kept for some time to ripen before being ready for use. This is not only ready for use as soon as mixed, but it remains good for many months after preparation.

Having obtained a supply of negative collodion—either by making or purchasing it, the latter course being recommended

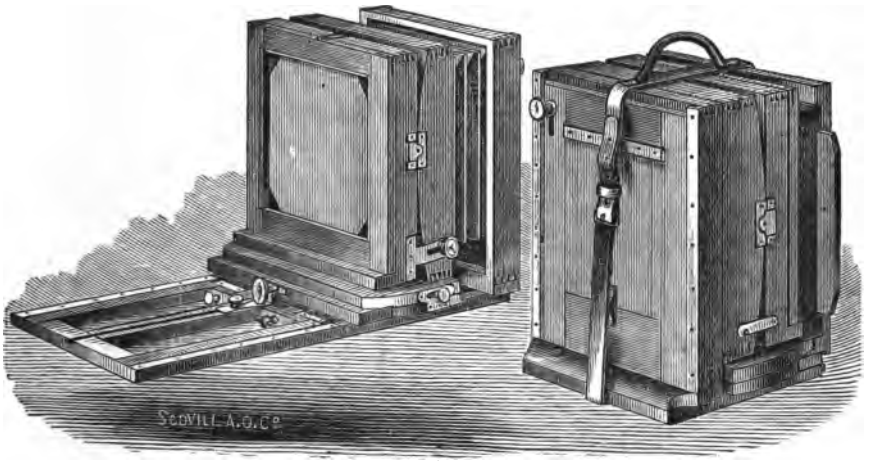
at this stage—it is next necessary that the negative bath, with its nitrate of silver solution, be in a state of readiness. Seeing that ample instructions for the preparation of the bath and the manner of coating a plate have been given on pages 13 and 14, it is enough that we here refer the reader to those instructions, and proceed to say that, while the plate is being made sensitive by immersion in the bath, the time may be usefully occupied in getting the sitter nicely posed, for we are now supposing that portraiture—either in a conservatory or well lighted room, on a garden lawn, or, better than all, in a room constructed or altered for the purpose—is to be practiced.

Here we may break away from the strict sequence of our subject to say that although a landscape or tourist camera can be made to answer for portraiture, one cannot possibly practice this department so nicely or successfully as if he were using a camera specially constructed for the purpose. Of portrait cameras there are many kinds. One which is much used by professional artists is shown in the cut on preceding page.

This is too heavy to rank under the category of "portable" cameras; stability and solidity, conjoined with facility of adjustment, are its leading characteristics. The various screws and milled heads seen projecting behind are for the purpose of imparting an inclination to the frame containing the sensitive plate, so that, for a reason to be explained presently, the axis of the lens shall not be necessarily placed at a right angle as regards the sensitive plate.

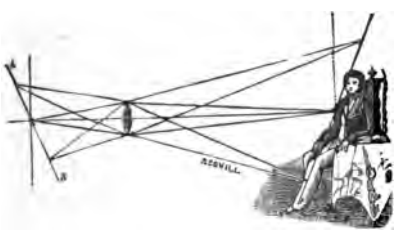
Not only is the portrait camera of a heavier and more solid description than that employed on a landscape tour, but a camera stand of a more solid nature is also required. Such a stand is shown in the drawing given above, in which the

requisite motions of raising or lowering the camera to suit the height of the sitter, or of inclining it in an up or down direction, are effected by handles conveniently placed. The legs of camera stands of this nature are fitted with castors to facilitate motion over the floor of the gallery or studio. But it frequently happens that many require solidity and por-



tability to be conjoined in a portrait camera. In what manner this may be obtained the above cuts show at a glance, and this so plainly as to require no explanation.

While our sitter is waiting till the plate has been four or five minutes in the sensitizing bath, we shall explain an allusion above given relating to placing the plate at a slight inclination as regards the sitter or the axis of the lens. It is a peculiarity of all lenses—although one most noticeable in the case of portrait lenses, which have a larger diameter as compared with their focus—that any object or portion of an object situated near the lens will be brought to a focus at a point further away than that of another portion of the original situated at a greater distance. Let us explain in what way this affects a sitter, who, as shown in the cut, is represented as posed in a sloping direction. Now, as the knees and lower part of



the figure are closer to the lens than the head and the background right over the head, it follows that the focus of that lower part of the figure will not be depicted on the same vertical plane as that on which the head is, and that, therefore, both could not be equally sharply delineated but for some contrivance for placing the plate in a slightly oblique position. These contrivances are designated "swing backs," and their advantage, in brief, consists in the power of getting into good focus the hands and knees of a sitter, who, but for the facility to twist or wriggle about the ground glass to suit the plane of delineation, would be sharp only in the face and bust, leaving the rest of the body indistinct. When operating with a large lens, giving good definition with full aperture, only one plane is represented with a passable degree of sharpness; hence, as the sitter cannot be forced into anything resembling that plane, it becomes necessary that the ground glass should be brought into such an approximation to the conjugate focus of the sitter as to secure a mean degree of sharpness throughout.

After the plate has been allowed to remain a sufficient length of time in the bath, which is ascertained by lifting it up and seeing if the surface is evenly wet without the appearance of greasy-like streaks, it is drained slightly and then placed in the dark slide. An exposure of a few seconds—more or less according to the light—having been given, the plate is brought into the dark room and developed. This is done by pouring over it a little of the following:

Protosulphate of iron,	¼ ounce.
Acetic acid,	1 "
Alcohol,	½ "
Water,	8 ounces.

The solution is applied by being poured along one edge. It will flow smoothly over the surface, this being insured by the alcohol. In a few seconds the image will appear—at first faintly, but rapidly acquiring strength and vigor up to a certain stage if the exposure has been properly timed. If it be desired to retain the picture as a glass positive, the development should be checked as soon as (by looking through the plate) the details of

the shadows are faintly visible. The application of water suffices to stop the action of the developer by washing it off. The difference between a positive and negative is merely one of degree. Both are negative when looked through, but in a positive the development is carried only so far as to produce a thin deposit of silver, while in the negative this deposit is allowed to proceed to such an extent as to produce strongly marked contrasts between the lights and the shadows. It is well that the tyro should confine his practice for a short time to the production of positives. When developed and washed, the picture is fixed by the application of a solution of cyanide of potassium of the strength of ten grains to the ounce of water. This solution may be used over and over again. The picture is fixed when (on looking at the back of the plate) all the iodide of silver is seen to be dissolved. It must then be well washed in common water and dried.

If it be intended to produce a negative, the development is carried farther than for a positive; the surface is then washed, and, if not sufficiently dense, any further degree of intensification given by applying a little of the following solution in the manner to be described:

Pyrogallic acid, - - - - -	4 grains.
Citric acid, - - - - - -	3 "
Water, - - - - - - -	2 ounces.

First put into a glass or porcelain vessel (there is nothing better than a porcelain egg cup) two or three drops of a thirty-grain solution of nitrate of silver, and then add as much of the pyrogallic solution as may be judged sufficient to cover the surface of the plate. Pour this on the plate the same way as the first developer. The image now rapidly becomes intense, this intensity being seen by looking through the plate. It is then washed and fixed as before stated, or, preferably, with a saturated solution of hyposulphite of soda. When dried, it is made warm and is coated with negative varnish, applied in the manner as described on page 25.

CHAPTER XI.

RETOUCHING NEGATIVES.

In portrait negatives it is frequently necessary to have to remove or hide defects in the face. This is known as retouching. It is legitimately employed when confined to the removal of defects such as those to which photography is heir, but is an abuse of the power when it is used to impart a wax doll texture to the furrowed face of an old man.

In order to retouch properly, the first requisite is an easel. There are many forms of these, but that shown in the cut is the simplest and best of any. It is susceptible of every kind of adjustment, and by means of a reflector placed behind, every detail of the negative, whether it be portrait or landscape, is plainly seen.

The retouching is usually effected by means of a long, finely pointed graphite pencil, some of several degrees of hardness being employed, according to special circumstances. Four pencils will be found to answer every requirement, the first being soft and black, the others increasing in hardness. After a long slope has been given to the point by a sharp knife, friction on a slip of fine sand or emery paper is then necessary to bring the extreme point to the requisite degree of fineness.

The negative to be retouched must have been varnished. If the surface be so smooth and hard as not to allow the pencil to "bite," it should either be roughened by gentle friction with powdered pumice stone or moistened with a weak solution of Canada balsam in spirits of turpentine, by either of which expedients the pencil may be made to take to the surface with readiness. If the varnish described on page 25 has been employed in the protection of the plate, no other preparation will be necessary, as the castor oil in it imparts the necessary tooth.

Having placed the negative on the bed of the retouching desk, and arranged so as to have it well lighted, examine the high lights first and touch out all the small specks or pinholes. A large magnifying glass held in the left hand, or fixed upon a stand, is useful in doing so. Where shadows, such as those under the eyes, are too deep, lighten them a little, and soften the wrinkles and furrows in the face wherever required. Freckles prove a fertile source of work to the retoucher, for although almost invisible in the living subject, the camera exaggerates their visibility to a sad extent, and the negative of such an one frequently looks as if riddled with pinholes. Patience, skill, and a sharply pointed pencil suffice to obviate this defect. Instead of confining himself to the use of the graphite pencil alone, the retoucher often employs india ink, or blue or pink pigments, applied by a camel's hair brush.

In retouching landscape negatives, it will be noticed that a grass foreground is usually more transparent than it ought to be, thus yielding a print in which this part of the picture is dark in an unnatural degree. This is also frequently the case with deep foliage, especially in the case of trees in the vicinity of a building of a light or gray color, for an exposure which would be prolonged to meet the requirements of the trees would probably be too great for the building. This disparity can be overcome by painting, with flat washes of color, upon the back or glass surface of the negative. A good pigment for this purpose is burnt sienna mixed with oil and megilp or mastic varnish. Very little must be applied, as it exerts a powerful obstructive action on the light. A convenient way to apply this pigment is by dabbing it on with the fleshy part of the finger top. This also affords the means by which mountains that are too obtrusive can be made to retire into distance, and by which vigor can be imparted to one portion of the picture at the expense of some other part.

When the sky of a landscape negative is thin, dirty, or uneven, it is better to render it entirely opaque, and print clouds in the proof by a second operation. Go round the edge of all the subject part with a fine brush and any kind of yellow paint. Take great care to preserve the outline of the picture

part, and afterward go over the whole sky with "opaque," taking care that no part is left uncovered. It may be applied on both sides if necessary.

A useful way to improve a landscape negative is to paste on the back a thin sheet of tissue paper, and then, holding the negative up against the light, going over it where necessary with a soft black pencil and a crayon stump. Instead of the tissue paper, the appearance of ground glass may be imparted to the back by an application of "ground glass varnish," a formula for preparing which is given in the Appendix. On the surface thus prepared any work may easily be put with the pencil.

After the amateur acquires a little skill and experience he may try his hand at painting in sheep on a lawn, swans on lakes, a boat on a river, or essay flights of genius in other or similar directions. It will have been understood that clouds may easily be painted in upon a landscape negative when the sky is not quite opaque, but thin enough to print with a tint.

CHAPTER XII.

MAGIC LANTERN TRANSPARENCIES.

THERE are two general methods by which photographic lantern transparencies may be prepared—the wet and dry processes. Of these each has its special advantage. For the photographer who can devote several consecutive hours during the day to the production of lantern slides, or who manufactures them on a large scale, the wet collodion process, employed in connection with a copying camera, is unmistakably the more advantageous; but to the amateur, who can only devote himself to this class of work during an hour or two in the evening, after the termination of his ordinary daily avocations, the dry process offers facilities of an exceptional nature, and possesses advantages considerably transcending those of the wet.

It is, of all things, indispensable that the high lights of the transparency be represented by pure glass, absolutely clean in the sense of its being free from any fog or deposit to even the slightest extent. It is also necessary that it be free from everything of the nature of heaviness or smudginess in the details. A transparency for the stereoscope is much better for having its high lights slightly veiled, as this prevents what is frequently termed a "snowy appearance," especially on the trees and vegetation; but with a well made lantern transparency such an impression is not conveyed to the spectators, even when the high lights are quite clear.

The operator is assumed to have a quiet hour or two at his disposal some evening, and to set to at his task of making a dozen transparencies.

The collodion must be one that works clean, without patchiness or undue intensity. This kind can be obtained without difficulty, hence time need not be occupied in giving any formulas for its preparation. The silver bath is one of thirty to thirty-five grains in strength, and need not be other than that employed in ordinary negative operations.

The plates, having been cleaned, must be albumenized, because one of the operations to be subsequently described has a tendency to contract the film, which would facilitate its slipping from off the glass were this not counteracted by the substratum of albumen. Now provide a large flat dish, such a one as that used for silvering paper, and into this pour the negative solution of nitrate of silver. A second dish, which may conveniently be of the same dimensions as the other, should also be provided; it is to contain acidulated water.

All things being ready, and the plates standing in a rack in front of the operator, one of them is collodionized and immersed, face uppermost, in the flat silver bath, its position being at one corner. Without corking the collodion bottle, a second, third, fourth, and so on to the last, are successively collodionized and immersed in the silver solution. All this is done by the light of a lamp shielded by yellow glass. By means of a silver wire hook, or a strip of ivory or vulcanite having a pointed end, the plates are removed from the bath in

the same order in which they were inserted, and are transferred to the water bath. The water, however, must have been largely acidulated with acetic acid; and here some explanation will be necessary.

It has been said that the ordinary negative nitrate bath may be used. This is the case. But an "ordinary" bath does not produce quite such clear transparencies as one containing a large proportion of acetic acid; it has, however, been found in course of experiments by the writer of these remarks, that, after sensitizing the plate in *any* bath, even though it were one producing foggy pictures, if such a plate were transferred to an acid bath for a brief period, no fogging would result. This led to the adoption of the expedient of pouring over the surface of the sensitized plate, previous to washing, a very strongly acidulated silver bath solution, which answered the purpose in an admirable manner. The further modification now suggested, that of washing the plate in acidulated water, is found to answer quite as well as the more cumbrous method formerly recommended. It possesses, also, the advantage of not necessitating any tampering with the silver bath, which, if good for negatives previous to the evening's work now laid out, will be equally so after such work has been effected. Cleanness and purity of the tones must be obtained at any cost; the cost here indicated is the lowest to which it is possible to reduce it, consisting as it does of a modicum of acetic acid per dozen of pictures.

From the acidulated water the plates are removed one by one, rinsed with plain water, and coated with an infusion made by digesting a dessertspoonful of ground coffee in a small cupful of boiling water, which must be carefully strained after standing for ten minutes. This simple preservative yields a cleaner picture and a more pleasing tone than any of those yet introduced.

When the plates have all been coated with this preservative, they are then dried by heat, although spontaneous drying answers quite well. Not until they are quite dry is the next operation proceeded with, viz., that of exposing. It is convenient that the dozen of negatives (or a fewer number if

duplicates are wanted) be racked on the right side of the operator, the plates being racked on his left side, both of these being illuminated by a kerosene lamp protected with yellow glass all round, except in front. This undoubtedly forms the best and most convenient method of illumination for the operating table; for, by the yellow portion of the light, the negatives may be selected and superposed each upon its sensitive plate; while, by the clear or white portion of the light, the exposure is to be made.

Translucent yellow paper, or, by preference, a transparent varnish colored with turmeric and dragon's blood, will indicate the means by which any man possessing ordinary intelligence may secure a local coloration of light.

By the process now being described, an exposure of twenty seconds—or, in the case of an exceptionally dense negative, of twenty-five to thirty seconds—will insure a fully exposed, first-class transparency.

The whole of the plates having been exposed, they must be developed in batches of four at a time. This is how it is done:

A solution is made, consisting of three grains of pyrogallic acid and two grains of citric acid per ounce of water, and to about an ounce (preferably less than more) of such solution a few drops of nitrate of silver solution are added just at the time of using. The first of the four plates to be developed is dipped in water, or flowed over with it, so as to wet the surface. This is followed by an application of the developer containing the silver, and the plate is laid flat, to allow it to act. The other three plates are treated in like manner, and by the time the last one has been attended to the image will be pretty well out on the first, which must then be taken in hand specially, and, if need require, be intensified by the addition of one or two drops of nitrate of silver to the now nearly exhausted developer. When found to be right, place the plate into a hypo. bath of moderate strength, and then direct attention in rotation to the others, which must be treated in precisely the same way.

The second and third group of the series of the dozen must

be developed and fixed in the manner adopted for the first, and the operator will be rewarded by finding himself possessed of twelve transparencies having a clear and pure tone, totally devoid of heaviness anywhere, the whites being bare glass, the blacks being of a fine, warm tone—neither too brown nor too "inky" in hue. No toning will be found requisite if these directions have been followed.

Rules for Constructing a Transparency and Copying Camera.—In all cases in which the production of lantern transparencies on a large scale is decided upon, it ought to be effected by means of a copying camera, the longitudinal dimensions of which are determined by the focus of the lens that is to be employed.

In order that a transparency may be produced from a negative of the same dimensions, it is essential that the lens be placed at twice its solar focal distance from the focusing screen, the same distance intervening between the lens and the negative. This, therefore, entails a distance of four times the focus of the lens between the two extremities of the camera, or, in other words, between the negative and the sensitive plate.

The nature of the lens that is to be used for this purpose is not of much consequence. It may be either a portrait combination, one of a kind specially constructed for copying, or even a single view lens; but it is undesirable that its focus be too long, as this causes the camera to be unwieldy to an unnecessary extent. For instance, the minimum length of a camera to be used with a lens of eight inches focus would be thirty-two inches. This, we say, is the *minimum* length. But the exigencies of making transparencies often demand a still greater length, in order to permit of the transparency being made a little smaller or larger than the negative. The optical law by which the relation of the negative and the sensitive plate to the lens is governed may be expressed as follows; and we desire to say that the formula is not applicable merely to the optical conditions involved in arranging a camera and lens so as to produce a transparency somewhat larger

or smaller than any given negative, but it embraces the whole subject of enlargement and reduction from any negative, even though the degree of enlarging be such as extends to the production of a life size picture from a tiny miniature.

The true equivalent focus of the lens having been ascertained, by means which we need not here stay to explain, let the focus—whether it be four, five, or six inches—be represented by f. What is now required are the two positions in which to place the negative (represented by n) to be enlarged and the focusing screen respectively so that a sharp image shall be produced, no matter what may be the degree of enlarging. Expressing one focus of the lens by u, and the other by v, we have the following:

1. $u=(n+1)\,f$, and,

2. $v=f+\frac{f}{n}$.

Those not familiar with such symbolic language will require that it be interpreted, which we now do:

1. Add 1 to the times of enlargement, and multiply the sum by the equivalent focus of the lens. The product is the length sought for.

2. To find the other focus, divide the equivalent focal length of the lens by the times of enlargement or reduction required, and add it to the equivalent focal length. The sum is the length sought for.

The various tables for enlarging are computed from the foregoing; and it is well that photographers should have a scientific system upon which to determine the length of their copying cameras, in addition to the tentative or "rule of thumb" one to which so many confine themselves. A little knowledge of this kind is *not* "a dangerous thing."

The copying camera must have, at its further extremity, a holder in which to retain the negative, a partition in or about the center, in which the lens is secured, and at the nearer end a place in which to insert the focusing screen and shield. All these must be capable of being adjusted so as to determine the proper dimensions of the picture, and it is most convenient

that such adjustments be effected from the rear end of the camera by means of slender iron rods which are either made to screw or to slide in and out. A quick-threaded screw is most convenient, but a simple sliding adjustment answers quite well. Each should terminate in a brass head. By the manipulation of one the lens holder is made to slide backward and forward, the other serving to regulate the position of the negative. A copying camera having a bellows body ought to be selected in preference to any other.

Placed upon a moderately firm table, the camera must be pointed upward, at a slope, against a part of the sky that is uniformly lighted. The diaphragm in the lens, as previously intimated, must be very small, and the image focused on the ground glass screen by means of a magnifier; for it must not be forgotten that magic lantern pictures are to be eventually magnified to an exceedingly great degree, and hence sharpness is indispensable.

The collodion must be rather old, and the bath acid. The color of the collodion affords a fair criterion of its fitness for the purpose of producing transparencies. There should be free iodine enough in it to cause it to be of a deep sherry color. As one or two trials will determine the proper degree of exposure with a given lens and stop, such will have to be ascertained by each photographer for himself. But after the picture has been developed there are two features that must be present in it, else it will be worthless as a production aiming to belong to the highest class. The high lights must be absolutely clean glass, and the deep shadows must not be opaque.

The first condition cannot be ascertained by looking through it against the light, in the manner in which transparencies are generally viewed, but must be determined by laying it, face down, upon a sheet of pure white paper, by which means the most delicate fog or veiling of the lights will be immediately detected.

The tone obtained by an iron developer containing acetic acid is rather too warm to look nice upon the disk. Besides, a picture which is of a light color when looked down upon in

the hand is not generally liked. To tone the image to a dark color, so as to look pleasing by reflected as well as transmitted light, some employ bichloride of mercury, followed by an alkaline sulphide; others immerse the transparencies in a bath of chloride of gold; still others prefer the tones obtained by uranium and ferricyanide of potassium; but that which we recommend on the present occasion consists of a one-grain solution of chloride of platinum, into which the picture is immersed, and allowed to remain until the darkness has penetrated through from the surface to the back of the film. This yields a tone pleasant to look upon and to look through, while the image will be absolutely unchangeable.

A rather weak solution of sulphide of potassium (liver of sulphur), applied after fixing, gives a tone of a rich chocolate brown character.

CHAPTER XIII.

FERROTYPES AND ALABASTRINE POSITIVES.

Allusion has been made to the production of a "positive" collodion picture by not carrying the development too far. These form, in many instances, pictures of great beauty, especially if the whites are pure.

The addition of two or three drops of nitric acid to each ounce of the iron developer tends to give whiteness to the image. This result is also obtained by fixing with cyanide of potassium instead of hyposulphite of soda, and an old cyanide solution is better than one newly mixed.

Ferrotypes.—When, instead of a plate of glass, one of japanned iron ware is made use of, the resulting picture is termed a ferrotype. Owing to the collodion picture being in *optical contact* with the black surface, the whites of ferrotypes

are not so pure and brilliant as when glass is the medium for supporting the film.

Alabastrine Positives.—It is possible to bleach a collodion positive on glass in such a way as to make the whites rival in purity that of the whitest paper or linen.

The solution required for bleaching a positive is easily prepared, and keeps well. In a dram each of hydrochloric and nitric acid dissolve as much bichloride of mercury as will saturate the liquid, then add a dram of alcohol and from one to two ounces of distilled water. Increasing these proportions, and placing them in a formulated shape, the mixture is as follows:

Hydrochloric acid, - - -	4 drams.
Nitric acid, - - - - -	4 "
Bichloride of mercury, - -	Quant. suff.
Alcohol, - - - - -	4 drams.
Water, - - - - -	6 ounces.

The positive that is to be bleached should be very clear in the shadows, being entirely free from any fog, and the extreme lights should be rather more dense than is usual in a glass positive. On looking over some pictures that have been bleached, we find that the finest one among them has a note on the back to the effect that it was developed by a mixture of pyrogallic acid and protosulphate of iron—the strength of the former being three grains, and that of the latter fifteen grains, to the ounce of water. The presence of a few drops of nitric acid was requisite to prevent the formation and precipitation of gallate of iron, for without this acidulous addition the developer would instantly have become as black as ink.

When the picture has been developed and fixed, it is thoroughly washed and placed on a leveling stand, and the requisite quantity of the bleaching solution poured over the surface. The picture will darken a little at first, but will soon begin to lighten up, the whole tint being of quite a different character from that which it possessed previously. In a short time, ranging from five to twenty minutes, it will have acquired a

fine pearly white appearance, after which it must be washed in water, the purity of which, for this purpose, is a matter of great importance. When dry, the whites are of a purer and more brilliant character than when wet.

The picture, after being whitened, should be washed with distilled water. The reason for this is that alkaline impurities in the water lower the tone of the picture—in proof of which let a bleached positive be immersed in water containing very little ammonia, hyposulphite of soda, or cyanide of potassium, and it will become dark in color; for alkalies and their carbonates, and some other salts, as well as lime water, decompose the material of which the image is formed, with the production of the black oxide, while ammonia converts it into that dark slate gray colored powder known as "black precipitate;" hence the importance of pure water for washing the picture.

It is worthy of notice that a picture whitened in this way retains its purity of color much longer than an ordinary collodion positive when both are exposed to the atmosphere. After being exposed for two or three years the whites may become a little dingier in appearance; but they can be restored to the original purity by wetting the surface with water, and then pouring on some of the original solution.

Instead of the bleaching solution given above, the following is said to answer well:

Bichloride of mercury, - -	40 grains.
Protosulphate of iron, - - -	20 "
Common salt, - - - -	15 "
Water, - - - - - -	2 ounces.

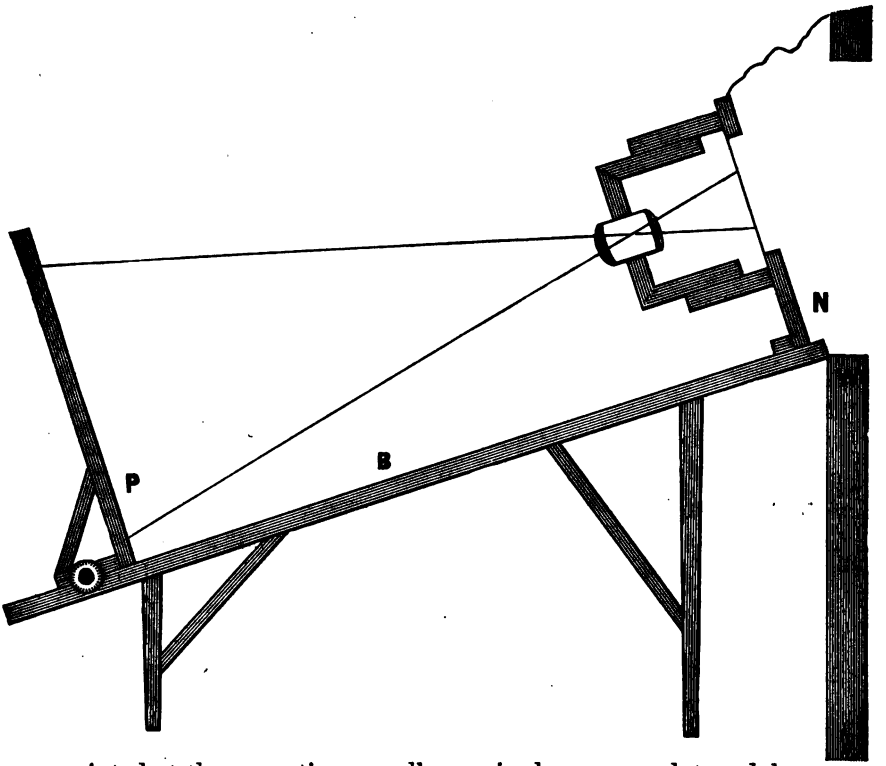
CHAPTER XIV.

COLLODION TRANSFERS.

By a collodion transfer is meant a positive or transparency which has been developed on glass and the film then transferred to paper or other support.

This process offers great facilities for rapidity of working. The author of this volume has been present in the atelier of M. Disderi, of Paris and London, at that time the *bon ton* photographer of Europe, where he has seen one man produce, "at each shot," a dozen of those exquisite cartes of certain members of the royal families of Europe for which he acquired such renown. These were printed in the following way: At one end of a copying camera was inserted a negative—varnished or unvarnished, it matters not—at the other end being the dark slide, adapted for a plate of large dimensions, and also capable of being subjected to a series of shifts, both from top to bottom and from one side to the other. Each shift brought the sensitive plate in front of a square aperture, in which was focused the picture to be printed. Between the negative and the "business end" of the camera the lens was inserted. To position No. 1 was given an exposure of say five seconds, the camera being directed upward against the sky; then a shift of the sliding back to position No. 2, followed by a similar exposure, and so on until the twelve or twenty-four (as the case may be) positions were secured. The images were then developed at one operation by protosulphate of iron, containing a liberal proportion of acetic acid, and after being fixed and toned by means of a wash of bichloride of mercury, a sheet of prepared paper was laid on the plate and pressed into contact with it; after which, without waiting till it became dry, this paper was immediately stripped from the glass, carrying with it the one or two dozen pictures thereon. By means of a punching machine the pictures were cut out of the sheet and then mounted without other preparation. In this way were printed hundreds of thousands of pictures, a

singular fact being that, notwithstanding the summary and quick treatment to which they were subjected throughout, many of those prints have proved more permanent than others



printed at the same time on albumenized paper and toned by gold in the most approved method.

At the present time the collodion transfer process is mainly applied to the production of cheap enlargements for club pictures, from fifty to a hundred of which can readily be made in one day by a workman who is skillful and systematic in his method of working. An elaborate treatise on this fascinating branch of photography would here be quite out of place, so we shall confine ourselves to giving such general directions as, if carefully followed, will insure success to the extent aimed at.

The apparatus commonly employed for collodion transfers is shown in the cut. W is the wall of a house, in which is a

window, through which the end of the enlarging camera is pointed upward against the sky. B is the base board of the camera, which may, and usually does, consist of a light framework made of pine. On it is supported a frame (N) capable of containing the negative, which is that of the portrait or landscape to be enlarged, although the apparatus now being described enables prints to be obtained not only larger, but the same size as or even smaller than the negative. The lens is supported as shown in the diagram, sufficient range being given to permit of all purposes of adjustment. It is important to observe that no light must be permitted to enter the apartment but what passes through the lens. This is an all-important condition of obtaining clean, bright pictures. The adjustable frame (P), which is invariably a solid slab of wood with cross pieces at the ends to prevent warping, serves to receive the focusing plate.

The image having been adjusted and sharply focused upon a plate of glass faced with white paper, a cap of yellow glass is put upon the lens, and a collodionized plate of glass made to take the place of that upon which the focus was obtained.

The collodion best adapted for transfers is one of a very tough and horny character. It should be rather thicker than that employed for small negative work, and it should also contain a greater proportion of bromide, both for the purpose of giving harmony in the lights and shadows and of keeping the former very clear and pure; for, be it remembered, a stain so feeble that it can scarcely be seen upon the picture while it is on the glass, becomes painfully apparent when it has been transferred to paper. A little fogging may sometimes prove beneficial when taking a negative, but in this process it is altogether inadmissible. Another quality which the collodion must possess is that of giving a thin or feeble image; for, if it be too intense, the finished picture will look heavy and smudgy, being quite devoid of details in the shadows. Good negative collodion, therefore, will not answer well until it has been diluted with twenty-five per cent. of plain collodion.

Some operators develop with iron, preferring to blacken the deposited silver afterward by means of the chlorides of mer-

cury, gold, or platinum; but most enlargers prefer employing a developer which will give a dark yet warm colored image possessing a pleasing tone without the necessity being experienced of having recourse to after toning, such as the following:

Pyrogallic acid, - - - - -	100 grains.
Citric acid, - - - - - -	60 "
Acetic acid, - - - - -	2 ounces.
Water, - - - - - - -	20 "

The image must be fixed with hyposulphite of soda. As it is well known that citric acid in a developer imparts a colder tone than acetic acid, this fact can lead to the adoption of any required degree of departure from the formulas. Further, there are many subjects in which a tone of a deep blue black character is absolutely necessary. A portrait of a black-bearded Italian or raven-tressed Spaniard would not convey a correct idea were it of a warm or brown tone. The finest tones are only obtained when the above developer is used within a few days of its preparation. The toning solution, when such is employed, must be allowed to act until the film has been penetrated to the back, which will be ascertained by turning the plate back foremost and inspecting the image through the plate.

After the image is developed and completed it is not allowed to become dry, but is at once attached to the paper that is to become its permanent support. When small prints are transferred, enameled paper is best for the purpose. This requires no preparation except being made wet with water. But it is customary for transfer enlargers to prepare their own paper. This is done by floating any good sample upon a solution of gelatine to which a little chrome alum has been added. To prepare this, place four ounces of gelatine in a quart of water, and allow it to soak for half an hour; then warm the vessel containing it by placing it in a second one of hot water. The gelatine will now become liquefied, when four grains of chrome alum, previously dissolved in a little warm water, is added, and well incorporated up with the gelatine. This is poured into a flat dish and retained in a fluid state by the application of gentle heat. The paper is coated by floating it upon the gelatine,

and a quantity ought to be done at a time, seeing that it will keep well, whereas the gelatine will not.

When this transfer paper is to be used it must be placed to soak in cold water for a few minutes, by which time the coated surface will have a slimy feeling. It is then laid, face down, upon the collodion picture, pressed lightly in contact with it, and reared away on edge to become dry. When stripped away from the glass the surface will be exceedingly glossy, being in this respect a counterpart of the glass plate upon which it was dried. This state is preferred by those who have to paint such pictures in oil; but when a mat surface is required the paper is stripped off before it is quite dry, or, if dry, it is allowed to lie in water for a short time previous to its removal. By attention to this, any kind of surface can be obtained at will. Of course, paper of any tone or color may be used as the final support.

To prevent the collodion film from adhering, the plate should, previous to its application, be well rubbed over with powdered steatite, popularly known as French chalk. A solution of beeswax in ether, or any other convenient solvent, will also answer the purpose of causing the film to leave the glass easily; but the French chalk will be found to be the handiest and best method of all.

CHAPTER XV.

CARRYING PLATES INTO THE FIELD.

If the wet collodion process be the one that is to be made use of by the operator, a dark tent, together with the chemicals requisite for sensitizing and developing, must form part of the outfit. How very cumbrous such an outfit is to the tourist is eloquently shown in the cut, in which is represented a wet plate photographer carrying his tent and baggage. No objection is offered to this mode of taking negatives—indeed, this would be done with an ill grace in the face of the fact that many thousands of gems of photographic art have been ob-

tained by aid of the tent and the wet collodion process, by which the photographer is enabled to see what kind of negative he has obtained before leaving the scene of operations.

But the far greater simplicity of operation connected with dry plates, and the small amount of baggage required, more than offset the advantage of having the negative developed on the spot. Moreover, such is now the state of certainty to which dry processes have been brought, that the photographer may employ the daytime in exposing his plates in the certainty that, if they were well prepared, they will on development yield good negatives upon his return home. The subject now to be inquired into is the best means of carrying the sensitive plates to the scene of photographic operations. There are three methods of doing so, each of which we shall describe. These are respectively the changing bag, the changing box, and the double dark slide.

The Changing Bag.—In this system the sensitive plates are usually brought to the field in a grooved plate box, from which they are transferred one by one to the dark slide, care being taken that all light is excluded from the box and the slide during the transference, which is safely accomplished by enveloping them both in an opaque bag while this is being done. In whatever way it may be constructed, the bag must have two short sleeves for the insertion of the hands, and the openings of these must be contracted by india rubber bands so as to close round the wrist and keep all light out. The transferring of a plate from the box to the slide is done by *feeling*, for unless the bag were large enough to allow of an aperture for the face also, one cannot see what is going on. But it is much easier to manipulate a plate in this way by feeling alone than one would readily imagine.

Several methods of carrying into effect the changing bag idea have been employed, but none, in the author's estimation,

better than one which he employed very successfully some years ago. In it the plate box is hooked upon the back of the camera, into which the slide remains inserted with its back open, the lid of the box being also open. The plate is grasped by the finger and thumb of each hand and raised up from its groove and placed into the slide, which stands open to receive it. It need scarcely be said that during this operation the bag must have been drawn over the end of the camera so as to embrace both the slide and box. Plates of the dimensions of 8 x 10 inches have been quite successfully transferred in this way. But this system has now been almost entirely supplanted by one or other of the following.

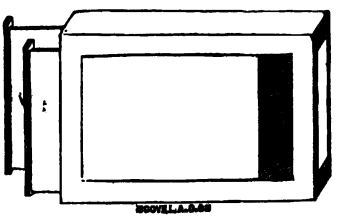
The Changing Box. —In this ingenious piece of apparatus the plates are kept in a grooved box with a lid in which is a slot of such dimensions as to permit of any plate of the series passing in and out through it, which, as the lid is made to slide backward and forward and possesses a register, can be done with great ease and absolute certainty. But there is a concealed shutter to the slot in the lid, and by means of a spring it always remains closed unless when the dark slide to which a plate is to be transferred from the box is placed in a proper position, the act of doing which automatically opens the shutter, so that when the box is slightly tilted a plate passes into the dark slide, in the end of which is an aperture corresponding to that in the plate box.

In this cut the plate holder or slide is shown when it is pushed into position on the top of the box, the effect of which is to

leave a clear passage way for any plate. After exposure in the camera the plate is returned to its groove and the lid made to slide to the extent of one notch, so as to bring the slot opposite the next plate.

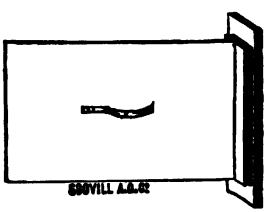
With a well made changing box a plate can be transferred from it to the dark slide in a few seconds. They are usually made to contain from twelve to twenty-four plates.

Double Dark Slides.—This agent for carrying plates into the field is, by general consent, the most convenient of all. According to the number of plates that it is felt desirable to expose, so may the number of slides be regulated from one to a dozen. There are numerous forms of double dark slides, but the description of one will here suffice, and, as it is one of the most recently introduced, it need scarcely be said that in it all the shortcomings of its predecessors have been eliminated.



In the adjoining figure is shown a view of this double slide with its two shutters partly drawn.

An end view of the slide discloses an aperture in which are three grooves, the two outer ones for the sensitive plates, which neatly slide into their places, the center groove being for a thin wooden partition having a spring on each side. This partition serves the threefold purpose of forming an absolutely opaque division between the sensitive plates, of pressing them firmly against the faces of their respective grooves, by which correct focus is insured, and lastly, of entirely closing up the aperture through which the plates were inserted so as to effectually protect them against the admission of even the faintest streak of light. There are many other forms of double dark slides, but this takes the palm in regard to simplicity and real efficiency.



When double dark slides are employed, each side of each one must be numbered so as to prevent the photographer from exposing the same plate twice over, and upon development discovering that he has obtained the anomalous incongruity of a pretty rustic cottage with children, sheep and cows all disporting themselves in the midst of New York Harbor amid ocean steamers, ferry boats and the almost infinite variety of shipping with which the bay abounds.

By entering each exposure in a note book, facility is also afforded for developing any one negative in particular, leaving the others to be treated at a more convenient time. When exposing plates one must never trust to memory for recollecting that such and such a plate is exposed, but should invariably have note book and pencil in hand on the removal of the slide from the camera, noting not only the plate and the subject, but also the length of exposure, the state of the light, the nature of the lens, and such other items as will conduce to comfort and certainty when developing.

CHAPTER XVI.

THE TAKING OF PORTRAITS IN A PRIVATE ROOM.

The proper lighting of the subject is of vital importance in the obtaining of a good portrait. The studio of the professional portraitist is constructed and arranged in such a manner as to permit of the sitter being lighted in the most effective way possible; and this gives him a great advantage over the amateur, whose efforts in portraiture have to be made under such circumstances as prevail at the moment, and which usually are not such as are conducive to pictorial effect.

And yet it is not only possible to produce gems of pictorial art in a private room, but in several instances such has been done. A more general knowledge of the best means of taking portraits in a private room will be useful, both to the professional and the amateur; to the former, because he may be called

upon to take sitters occasionally at their own residence, and to the latter, because he has often no other place in which to take them.

There are two systems by which private room portraiture may be practiced—the one direct, the other by reflection. By the direct method, the sitter is placed in such relationship to the window that the light shall fall upon him in an agreeable manner. Place the sitter and camera as you may, it is extremely difficult to get a really fine portrait in this way, unless by a very complete system of reflectors not easily obtained or managed. A room rather low, and having a dome roof with a window in it is best.

The system by reflection is so greatly superior to the other that we shall give a somewhat full description of it, and to simplify matters we assume that the intended photographic operations are to be conducted in a room having a single window of an average size, and with, preferably, a northern exposure. If the window even faces the south it will not be of great consequence so long as the direct rays of the sun are not permitted to enter or to fall upon the sitter. There are so many expedients which may be resorted to in order to prevent access of the direct solar rays, that detailed precautionary measures need not here be given.

Let the reader please to seat himself a little distance—say a yard or thereabouts—from the window, and then let him further carefully scan his own features in a mirror on a small table placed close to the window. After studying the effect of the lighting of the face, let him move the chair a little to one side (a few inches will answer) and note the different effects produced—the fine roundness and the perfect modeling. One idea is almost certain to take possession of the sitter as he thus studies himself with a view to portrait effect, viz., that if he could only secure a photograph of himself thus lighted, it would be a portrait indeed.

We now advance a stage further, and ask the reader to request a friend to occupy the chair in front of the mirror, while he seats himself at one side of and slightly behind his subject, and, from this point of view, examines his friend's image in

the mirror. In order to do this the mirror must be turned slightly toward the spectator, on the well known principle of the angle of incidence being equal to that of reflection, which angles in this case represent the spectator and his friend. A repetition of the previous operation of moving the sitter a little toward one side or the other will secure the best effect of lighting.

At this stage a camera is brought on the scene of operations, and is made to take the place of the experimentalist. It is sufficient here to say that the image seen in the mirror may be photographed after an exposure which will provoke astonishment in consequence of its brevity.

Let us now treat of the matter in detail, and discuss each topic connected with it under a special heading.

The Amount of Light on the Sitter and the Rapidity of the Exposure.—Rapidity of exposure is determined by the quantity of light by which the sitter is illuminated. Intensity of illumination may be obtained either by a sunbeam falling directly on him through an aperture just sufficient to admit it, or conversely by a large amount of light coming from every quarter. In the former case the picture will be hard, the transition from light to shade being too violent; in the other it will be too flat from the opposite cause.

If a person seats himself in front of a window of average size (that by which most of our experiments were tried having a clear aperture of seven feet by forty-four inches), and ascertains the vertical and horizontal angle of the light that falls upon him, he will find that it is in excess of the light commonly admitted in photographic studios. This is a fact that may be determined by simple measurement and comparison. It is not the size of the studio or its window that determines the force of the illumination, but the angular relation of the window to the sitter. Hence a window which is twelve feet square may, in reality, admit a far less degree of light, so far as a special sitter is concerned, than one of six feet square, the area of which is only one-fourth that of the former size. From what has been said, it will be perceived that, if a person

sit sufficiently near to a window, more light will fall upon him than would be the case in many studios. For the same reason it will be seen that in proportion as he removes his seat from the window, the light diminishes according to the square of the distance.

Concerning the Mirror and its Alleged Disadvantages.—There are two or three objections to the employment of a mirror which thrust themselves prominently forward. These are—first, an ordinary mirror gives a double image; secondly, it necessarily gives a reversed image; and, thirdly, it absorbs light. We shall examine these in detail.

Respecting the doubling of the image seen in a mirror, this is *theoretically* a good and solid objection to the use of a common mirror for any purpose, because two images of every object incident upon it (except the pupil of the observer's eye, when the mirror forms a right angle with the optic axis) are formed—one by reflection from the anterior surface of the glass, and the other and principal one from the metallic coating on the back surface. But the double image of a person in front of a mirror is only visible when the angle composed of the incident and reflected ray is obtuse, and this condition is not in force when using a mirror for taking a portrait in the manner now being described. Take an ordinary small table or swing mirror of, say nineteen by fifteen inches in dimensions, and having placed it on a table close to the window, let a sitter be arranged about a yard from it, and so seated as to present to your eye a perfect profile. Now inspect the image very carefully, keeping so near to the sitter as just to afford you an uninterrupted view of the mirror, and a solid image without any appearance of doubling will present itself.

In order the better to ascertain this, take a negative of this reflected figure and examine it carefully, even by a magnifying glass; you will have a head and bust on which it will not be easy, if at all possible, to discover anything amiss. Theoretically, there are not merely two, but many images; but as only one of them is visible, what matters it if there were a thousand?

It may be urged as an objection that the use of the mirror in the manner recommended produces a reversed image. Although for several purposes this may, by many, be looked upon as an advantage, yet it can be rectified either by the rectangular prism, the reversing mirror, or the reversing camera frame.

The third objection is that the mirror, by absorbing light, will lengthen the time of exposure. So it materially would if an old mirror composed of thick plate glass of a deep yellow tinge and with imperfect silvering were used; but the glass of which mirrors are usually made is carefully selected with reference to freedom from color as well as from other defects. So little light is lost that we venture to affirm that if a mirror be composed of a good and well polished sample of glass, and be silvered by one of the patent processes now so much adopted, the increase required in the duration of the exposure will be so trifling as to make no practical difference to either the photographer or the sitter; an increase of one second in the twelve would probably be more than sufficient to counterbalance the loss by absorption.

We have purposely abstained from making any reference to the means by which "effects" in lighting may be obtained. Two small portable screens—one of them covered with white and the other with dark paper—provide the means of securing every kind of effect that can be desired. Backgrounds and accessories of all descriptions may be used; but, owing to the rapid diminution in the intensity of the light, it is necessary to have the background not too far from the sitter, otherwise it might be darker in the finished picture than would be considered desirable.

CHAPTER XVII.

THE CONSTRUCTION AND USES OF PHOTOGRAPHIC LENSES.

THE variety of photographic lenses at present in use may well mystify the incipient amateur, but from the notes which follow it is believed he will acquire samething akin to a clear idea of them, their nature, and objects.

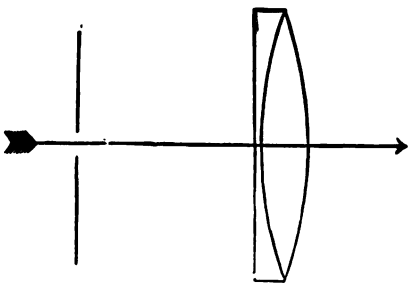
Forms of Simple Lenses.—A lens consists of a piece of glass, one or both surfaces of which are ground and polished to a curve. According to the nature of that curve so is the distinctive name of the lens. If one side is flat and the other convex, the lens is a *plano-convex;* with both sides convex, it is a *double convex* or *bi-convex;* the same when the surface is hollow instead of being rounded, in which case it is a *plano-concave*, or double concave, as the case may be. A convex lens magnifies when looked through; a concave lens diminishes the apparent size of the object looked at. When one side is convex and the other concave, the lens is termed a *meniscus* or *periscopic.*

The names just mentioned hold good not merely in the case of a simple lens formed of a single piece of glass, but of one built up of several other lenses in contact with each other, the distinctive appellation being determined in such a case by the external surfaces.

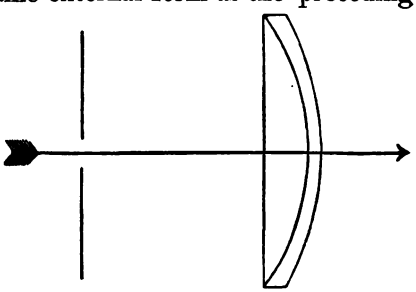
Most photographic lenses, although apparently consisting of but a single piece of glass, consist in reality of two lenses formed of different kinds of glass and united together by a transparent cement. The large lenses of telescopes in most instances consist of three single lenses thus cemented.

Achromatic Lenses.—Compound lenses of the nature just described are termed *achromatic*, on account of their transmitting a ray of light without decomposing it into the various colors of which white light is constituted. By transmitting a ray through a *single* convex lens a confused image

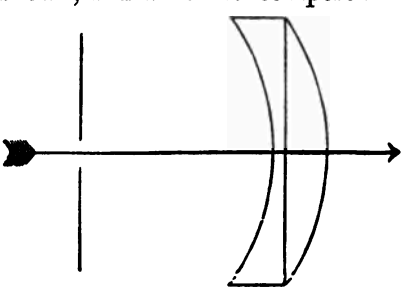
will result, owing to the blue portion of the light coming to a focus nearer to the lens than its yellow and red constituents. This is counteracted by placing in contact with such a lens oneformed of denser material, having a different ratio of dispersion, only concave instead of convex. The most common form of achromatic lens is composed of a bi-convex lens of crown glass cemented to a plano-convex lens of flint glass, the contact surfaces of which, being of similar radius, are joined by such a cement as Canada balsam. Such a lens is shown in the diagram, which also shows in what manner the ray of light falls upon it through a diaphragm placed a little way in front. This lens is a plano-convex achromatic.



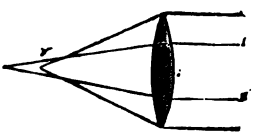
But a lens having the same external form as the preceding one may be achromatized in a different way—namely, by cementing a flint concave meniscus (or concavo-convex) to a plano-convex crown lens, as shown in the diagram.



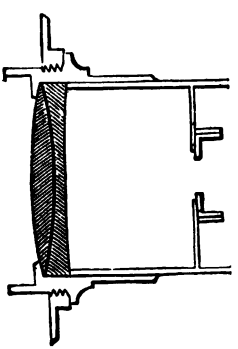
If a very deeply curved meniscus achromatic were wanted it could be obtained by means of the combination now shown, and which is composed of a plano-convex crown and plano-concave flint, being cemented at their flat surfaces, although it is seldom that opticians make these surfaces absolutely flat, for when slightly curved it gives great power in the proper correction of the lens.



The best form of lens for ordinary landscape work is one constructed on the principle of those described, but owing to the inability of a lens to transmit to a sharp focus all the rays from an object which fall upon every part of its surface, a diaphragm must be employed. The nature of this aberration of sphericity (spherical aberration) is shown in the following diagram, in which parallel rays are seen falling upon a lens, those near the margin being brought to a focus nearer than those more centrally transmitted. This kind of aberration is quite distinct from that of color, and in optical language one is *positive spherical aberration* and the other *chromatic aberration.* The latter is cured by constructing the lens of two kinds of glass; the other, for the purpose now under consideration, being rectified by a diaphragm placed in front of the lens.

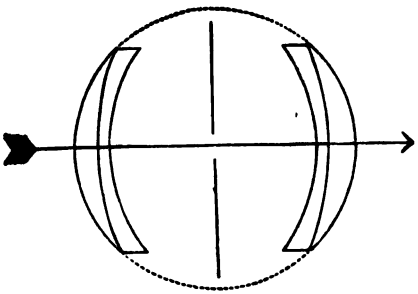


The Landscape Lens.—With these remarks by way of explanation, we now introduce the achromatic landscape lens, which gives pictures possessing great brightness, sharpness, and vigor. It will be seen that there is a diaphragm placed in front of the lens. This produces great sharpness all over the picture, and it is also causes objects which are situated at varying distances to be equally sharp one with another. If the diaphragm (usually designated a stop) were removed, the image would be deficient in vigor and sharpness. It may be suggested that this end might be attained by making use of a small lens no larger than the aperture in the diaphragm quite as well as by first making a large lens and then stopping it down; but this is not the case. While the center of the picture thus formed would be sharply delineated, the sides would be indistinct. The diaphragm permits the center of the picture to be made by the center of the lens, and its sides by those rays only which pass through near its margin, by which condition marginal sharp-

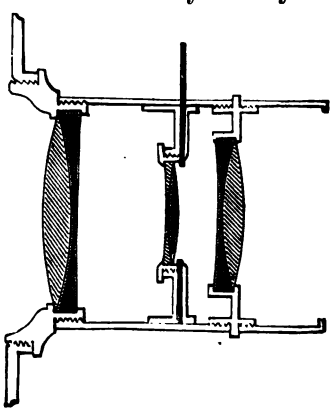


ness can alone be secured. On page 11 will be found some other remarks on the use of the diaphragm.

Non-distorting Combinations.—While admirably adapted for landscapes, the lens last described is not well suited for architecture on account of its tendency to impart a degree of curvature to lines near the margin which should be quite straight. This is termed curvilinear distortion, and to cure it a combination of lenses must be employed so as to fulfill a condition which may be expressed by saying that, in order to project a picture absolutely free from curvilinear distortion, all rays which fall upon a lens or *objective*, as it may, with perhaps more fitness, be termed, must emerge after transmission in a direction parallel to that at which they enter. Symmetry in the combination of lenses, as shown in the above diagram, secures this condition, and an objective of this nature gives pictures quite rectilinear. The objective here shown, known as the globe lens of Harrison and Schnitzer, was the first achromatic combination ever introduced which gave a correct picture.

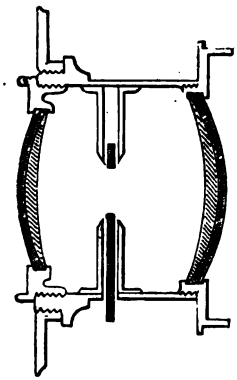


But there may be optical without mechanical symmetry in a lens, and such is found in the *triple achromatic*, a combination which, though not including such a wide angle of view as the *globe*, gives sharp definition with a far larger opening, and consequently works more rapidly.

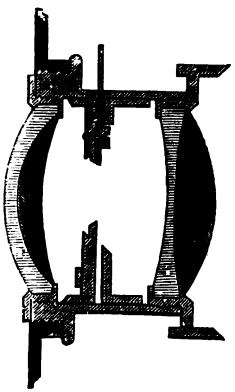


The maker of the triple achromatic here shown (Dallmeyer) afterward introduced a simpler form, similar to the American *ratio lens*, which was like the *globe*, but had one lens

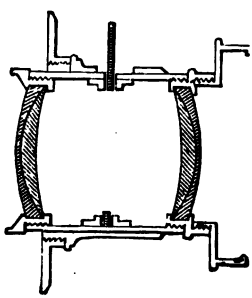
rather smaller in diameter and shorter in focus than the other. It includes a wider angle than that lens, and, as will be seen, the lenses are achromatized in a different manner; for, whereas in the *globe* and *ratio* lenses the lighter elements, or crown glass, of which the achromatic is composed are placed to the outside in both front and back lenses, in this one the relative positions are reversed, the flint or denser material being placed outside; and this condition, it may here be stated, at present prevails in the great body of combination lenses now made, with the exception of the portrait combination which will be described hereafter.



The original wide angle objective of Ross has each of its lenses achromatized in a different manner. Like the lens mentioned in the previous paragraph, it includes a very wide angle —about ninety degrees on the base line of the picture. The manufacturers of this combination have in a large degree discontinued its construction in favor of a better form in which the denser glass is placed to the outside, both front and back lenses being similar.



The next lens is one which works with an aperture sufficiently large to enable portraits to be taken in a good light. It was introduced simultaneously by Steinheil and Dallmeyer, the former making it of *flint* glass of two different degrees of density, and securing achromatism by that means, the latter obtaining the same effect by the use of crown and flint glass of a special kind. Both are aplanatic and rectilinear. Many lenses of an almost similar kind to the original Steinheil are being manufactured and sold under a variety of

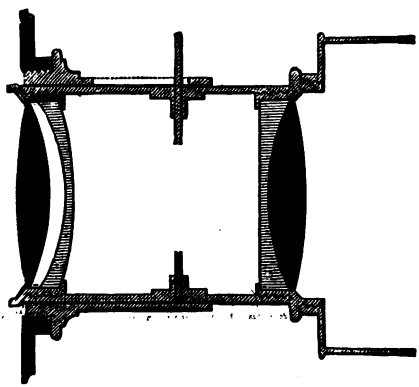


names by various opticians, all of them being represented by the diagram.

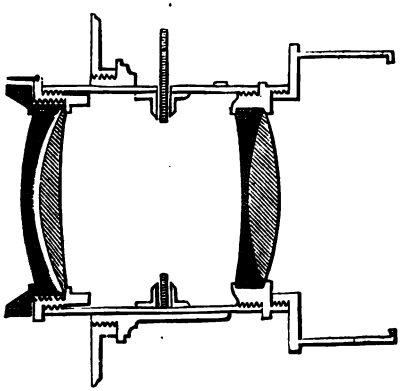
By making the lenses much thicker than is above shown, also with shorter radii of curvature, Steinheil was able to bring them much closer to each other, and thus to include a very wide angle of view. This modification of the original form is now, like the former, manufactured and sold by different makers under different names. In justice to the originality of an American optician, it may be said that there is not either a wide angle or a rapid lens made at the present time which is not represented by one or other of the drawings or descriptions given above, except those of Morrison, of New York, whose "rapid" objective consists of a symmetrical compound, each achromatic lens of which is composed of a plano-convex crown placed in close contact with a bi-concave flint, the concavity of the side of which that is next the crown being only very slight, thus leaving an air space between the elements of which the achromat is formed.

The wide angle lens of Morrison consists of an achromatic meniscus as the front and a simple meniscus as the back lens, the front one being over-corrected to an extent sufficient to counterbalance the non-correction of the back for achromatism. It includes an angle of great width.

Portrait Lenses.—The conditions required in a portrait lens are the transmission of the greatest possible amount of light so as to shorten the time of exposure, coupled with extreme sharpness when no diaphragm is made use of. The relation between the working aperture of a lens and its focus is termed its *angular aperture*, and in a portrait lens, unlike any other in this respect, it is essential that the angular aperture be very great.



The means of obtaining these conditions were discovered by Professor Petzval, whose invention of the portrait lens was launched upon the world in such a perfect state as not to have required any modification worthy of the name ever since. It consists, as shown in the foregoing diagram, of a plano-convex achromatic (or one *nearly* plano-convex) as the front, with a double convex achromatic for back lens. The inner or contact surfaces of the constituents of this back lens are not of the same radius of curvature, and, besides, they are separated from each other to a slight extent. This produces *negative spherical aberration*, or aberration of an opposite nature to the *positive* aberration illustrated in a previous diagram, and which produces the effect of lengthening the oblique rays, and thus flattening the field of delineation. The angle of subject is only small, but it is not required that it be large.



Several opticians are now constructing lenses with a back combination, originating with Dallmeyer, differing from that just shown, and the nature of which will be seen from the cut adjoining. The negative aberration necessary for flattening the field is obtained by the non-concentricity of the contact surfaces by which a meniscus of air is always interposed between them. Unless the two back lenses are kept screwed closely together, a sharp picture cannot be obtained. Therefore, if in any case an out of focus effect is wanted, it may by this combination be secured, as the separation of the lenses introduces a degree of aberration inimical to sharp definition.

Let it be well understood that in this chapter there has been no attempt to enter into the optical principles involved in the construction of photographic lenses, but merely to give such a

popular account of the general construction of and show the points of difference between various lenses as shall prevent the amateur from being altogether ignorant of the nature of one of the principal "tools" with which he will have to work.

How to Ascertain the Equivalent Focus of a Lens.—Each photographer should know precisely what is the equivalent focus of every lens he employs. By the "equivalent" focus is meant that measured from the optical center of the combination, and which yields an image of a size corresponding with that obtained by using a very thin simple lens like a spectacle glass. The knowledge of this is requisite for copying, enlarging, and other purposes.

The *equivalent* focus of a lens can be discovered in a variety of ways.

A useful method, which, however, does not yield results of *absolute* accuracy, consists in placing a piece of any printed matter in front of the camera and drawing out the ground glass until the original matter and the image on the ground glass shall be the same size. Now measure the distance between the ground glass and the printed matter, and one-fourth of that measurement is approximately that of the equivalent focus of the lens.

A more accurate way is as follows:

Having, in the first place, drawn two lines from top to bottom of the ground glass, at equal distances from the center, and distant from each other say three or four inches—a precise distance is not required—spread a sheet of paper on the table, and place upon it the camera pointed to any well defined object at a distance, such as a tree or a house. Having first of all focused the image, cause the object to fall exactly on one of the lines drawn upon the ground glass, and then with the pencil draw a line on the sheet of paper on which the camera is placed, using the side of the camera as the ruler. Now turn the camera so far as to make the image of the house or tree move from the first line to the second, and when that has been done with the pencil draw another line the same as before.

These lines are placed at an angle to each other. Now, by means of a straight edge and pencil, extend them until they meet at a point,

You have now the angle through which the camera has been moved. Draw a line between these two, which line must be equal in length to the distance between the two lines on the ground glass, and be so placed that it shall *just* touch the two previously drawn, something like the cross line on the letter A. Now measure the distance of the intersection of the two first lines and the third line, and you have the "equivalent focus" of the lens.

APPENDIX.

REMOVING SILVER STAINS FROM THE HANDS OR LINEN.—Mix together

Iodine, - - - - - - -	2 parts.
Nitric acid, - - - - - -	2 "
Muriatic acid, - - - - - -	2 "
Alcohol, - - - - - -	40 "

Apply this to the stain, which then becomes easily removable by subsequent application of hyposulphite of soda or cyanide of potassium. When the stains have disappeared, wash well.

A paste made of chloride of lime and water also proves highly efficacious for this purpose when used with cyanide of potassium.

The following method (by Griswold) is efficacious, and is quite safe if the directions are followed:

Ammonia, - - - - - -	½ ounce.
Alcohol, - - - - - -	3½ ounces.

Add iodine in such quantities as to eventually retain a sherry wine or amber color. Apply with a stiff brush, several times if necessary, and then wash with soap and water. Safety here consists in having the iodine in such excess as to give the color above described; for when the ammonia is in excess, the teriodide of ammonia is formed, which, under certain circumstances, may explode with violence.

Let it be observed that cyanide of potassium, like some other chemicals used in photography, is very poisonous; and when it has done the work required of it in removing stains, it must be removed from the pores of the hands by a thorough washing. For this reason cyanide should be avoided whenever hyposulphite of soda will answer the same purpose, which unfortunately is not the case at all times.

TO REMOVE DISCOLORATION FROM GELATINE NEGATIVES.—Immerse the plates in a solution of alum just after fixing. If

to this be added citric acid, the effect is more energetic. The following proportions are recommended:

Alum,	1 ounce.
Citric acid,	2 ounces.
Water,	10 "

This not only removes discoloration, but reduces an over-developed negative. Another excellent method is by immersing the negative in a saturated solution of alum to which has been added sulphuric acid, in the proportion of one dram to the quart. A third process consists in the application of a strong solution of oxalic acid previous to fixing.

Frilling and Puckering of the Film.—This sometimes takes place during very hot weather, or when the emulsion has been made of a very soluble kind of gelatine. By flowing over the surface just before development an exceedingly thin, plain collodion containing alcohol in large proportion, this will be obviated. The plate must be rinsed after this application until the "greasy" appearance goes away. A ten-grain solution (that is, ten grains to the ounce of water) of tannin will also harden the film. A solution of alum answers the same purpose. It is always a safe precaution to flow either tannin or alum over the plate between developing and fixing, this more particularly when the weather is very hot and there is no ready access to iced water.

To Prevent Films Splitting and Leaving the Plate upon Drying.—This mishap will sometimes occur, owing to some defect or peculiarity in the collodion or glass surface. To prevent it, pour over the negative, previous to its being dried, a weak solution of gum water or albumen.

To Intensify Gelatine Negatives.—When negatives of this kind are too thin and feeble to give vigorous prints, soak them in water for a few minutes and then apply a saturated solution of bichloride of mercury. By this treatment they become bleached and turn of a bluish white color. Now wash thoroughly and apply a weak solution of either sulphide of

potassium, hyposulphite of soda, cyanide of potassium, or ammonia very much diluted.

A favorite intensifier with many consists of

No. 1.

Bichloride of mercury,	60 grains.
Water,	6 ounces.

No. 2.

Iodide of potassium,	90 grains.
Water,	2 ounces.

No. 3.

Hyposulphite of soda,	120 grains.
Water,	2 ounces.

No. 2 is poured into No. 1, and the precipitate thus formed is dissolved by adding No. 3. This intensifier is very effective and imparts a fine color.

When great intensity is required, as for photo-engravings, apply a solution of bromide of copper, the strength being immaterial so long as it whitens the image in a moderate time; then wash and apply a weak solution (say from 2 to 10 grains to the ounce) of nitrate of silver.

Care of Lenses.—Never touch the polished glass surface with your finger; but, if it be dusty, invariably wipe it with a soft wash leather. Also, do not allow a lens to be exposed for any length of time to the sun's rays, as the flint glass in the achromatic compound is sometimes apt to become discolored by strong light, by which it is made to work slower than before.

To Measure the Angle of View Included by a Lens.—If the base line of a landscape or other picture equal the focus of the lens by which it was taken, the angle of view included is 53 degrees. If such base line equals twice the focus of the lens, the included angle is 90 degrees. If it measures a quarter more than the focus, an angle of 64 degrees is represented; if one half more than the focus, 74 degrees is indicated.

Tilting the Camera.—It is often necessary to point the camera upward in order to get in the whole of a building. This causes the lines of the building in the photograph to converge, producing the "distortion of convergence." To prevent this, swing the back of the camera until the ground glass assumes a *perfectly vertical position*, when the building will be delineated with entire freedom from distortion. Guard against the slightest departure from this rule.

To Take a Sharp Photograph During a Gale of Wind.—The vibration of the camera during a gale of wind may be prevented by attaching a piece of string to the screw of the tripod head, allowing it to drop upon the ground, and then placing the foot firmly upon it. Care must be taken to pull up the slack, so as to insure that portion between the foot of the operator and the camera being tightly strained.

Ink Stains on Photographs.—These may be removed by applying to the stains, by means of a camel's hair pencil or a tuft of cotton wool, a moderately strong solution of oxalic acid. Muriatic acid also answers the same purpose. Neither of them injure the photograph if it has been properly toned. Copious washing must follow the removal of the stain.

Litmus Paper.—This paper serves as the means by which any solution is known to be acid, alkaline, or neutral. It is both red and blue. To test a liquid, immerse a small bit of blue litmus paper, and if it be acid, even in the very slightest degree, the paper will become red. If the solution be alkaline, the blue litmus will not be affected, but, on the other hand, a piece of red litmus paper will become blue. If neither of them undergo a change of color, the solution is neutral.

To Ascertain when a Print is Thoroughly Washed.—Hang up to dry, and collect the droppings in a test tube or wine glass. In a small test tube place ten drops of thin boiled starch, and add two drops of an aqueous solution of iodine. To the blue liquid thus obtained add ten or fifteen drops of the washings. If there is hyposulphite of soda present the color will be discharged. If the blue color remain unchanged the print has been thoroughly washed.

Enameling Paper Prints (Glacé Pictures). — An extremely brilliant and polished surface is given to photographs in the following way: A plate of glass, made quite clean, is rubbed over with French chalk, and then coated with tough plain collodion. When this is set, it receives a further coating of gelatine, made in the proportion of one ounce of gelatine to twelve ounces of water. This should be filtered so as to insure perfect cleanness. The gelatine film should be allowed to become quite dry. The print, also previously gelatinized, is rubbed in close contact with the prepared plate, both being first wetted with water. When *quite* dry the paper is stripped from the glass, from which it removes the collodion film now cemented to the print.

To Recover Silver from its Solutions.—If the solution be that of the nitrate, it may be precipitated as chloride by the addition of a solution of common salt; as metallic silver (in the form of a dark colored powder) by inserting a slip of copper; or as the oxide by the addition of a solution of caustic potash.

The silver is recovered from old hyposulphite of soda fixing baths by throwing it down as sulphide by the addition of a solution of sulphide of potassium.

To Reduce Chloride of Silver.—Chloride of silver may be reduced to the metallic state by acidulating it with sulphuric acid, and then immersing a strip of zinc. In a few hours the chloride will be converted into metallic silver.

Buying Silver.—Metallic silver is invariably bought and sold by troy weight, 480 grains constituting an ounce. Nitrate of silver, on the contrary, is always sold by avoirdupois weight, an ounce of which contains only 437½ grains.

Preservative Solutions for Dry Collodion Plates.—In addition to the coffee and tannin preservatives described at page 18, there are others which may be used with admirable effect. The *hot water process* consists in applying to the plate, after the silver solution is thoroughly washed off, a solution of albumen (the white of one egg to six ounces of water, well beaten together and allowed to settle), which is made to flow

over every part. The plate is then immersed in hot water, by which the albumen becomes coagulated. Some connoisseurs allege that this is the finest of all the numerous photographic processes. A rather long exposure is required, but the quality of the image cannot be surpassed.

A simple solution of gum answers well as a preservative, and when mixed with tannin and rendered alkaline it yields plates possessing great sensitiveness. Take

Gum arabic, - - - - - -	1 ounce.
Sugar candy, - - - - - -	½ "
Water, - - - - - - - -	4 ounces.

with ammonia enough to render the solution slightly alkaline to test paper. With any quantity of this, mix an equal proportion of a ten-grain solution of tannin. Pour on and off repeatedly until the film becomes permeated, after which wash off. After standing a day the gum becomes acid, in which state it will not answer.

The number of substances suitable for preservatives of dry collodion plates cannot easily be reckoned. Among others than the above, by which the finest results have been obtained, are coffee, tea, malt and many other substances. As a hint to those who are aiming at great sensitiveness in dry collodion plates, it may be mentioned that some of the salts of morphine, such as the acetate, when used as a preservative, give an exalted degree of sensitiveness.

Extra Quick Dry Collodion Plates.—Coat with collodion containing eight grains bromide of cadmium; excite in a seventy-grain silver bath; wash well; apply a ten-grain solution of tannin and once more wash. This gives a plate which when dry is more sensitive than a wet collodion one. It must be developed with alkaline pyro.

Ground Glass Varnish.—The following formula will be found to produce a most superior varnish:

Sandarac, - - - - -	90 grains.
Mastic, - - - - - -	20 "
Ether, - - - - - -	2 ounces.
Benzine, - - - - -	½ to 1½ ounce.

It is the proportion of the benzine present that determines the degree of granularity of the varnish, hence each must decide upon this for himself, for while some like to have a varnish that will produce a coarse or granulated surface, others prefer it to be very fine.

Microscopic Enlargements.—Any one possessing a microscope may obtain enlarged photographs of minute objects in the following manner: Having extended the camera as far as possible, remove the lens and insert in its place the eyepiece end of the microscope, which has previously been turned in a horizontal position. Care having been taken to prevent any light from entering the camera, except what is transmitted through the microscope, and the light being properly adjusted, upon focusing an object on the stage of the microscope, a bright image will be seen upon the ground glass of the camera. This is a branch of photography that may very easily be conducted at a parlor table in the presence of a few friends. If a somewhat low power objective, such as a one-inch or two-inch be employed, a bright kerosene lamp forming the illuminating medium, an exposure of from one to five minutes given to a sensitive gelatine plate will suffice to yield an enlarged photograph of an object. But the precise length of exposure must be determined by the degree of amplification desired and the nature of the object.

Syrupy Lactate of Ammonia.—This preparation, the use of which we have recommended at page 27 as a useful agent in the preparation of dry plates, is not kept by many chemists for sale, hence it is important that each be able to make it for himself. Into a vessel of any convenient form, such as a graduate or a small wide mouth bottle, pour any desired quantity of lactic acid, which is a thickish fluid, then add a *little* liquid ammonia and stir well with a glass rod or a strip of glass. Test with blue litmus paper, and continue adding ammonia so long as the litmus is reddened by the liquid. If too much is added, which is ascertained by red litmus becoming blue, add one or more drops of lactic acid until the liquid is neither acid or alkaline. Keep for use in a stoppered bottle.

SYNONYMS FOR A FEW PHOTOGRAPHIC CHEMICALS IN COMMON USE.—It frequently happens, especially in the smaller towns and villages, that when a certain chemical is inquired for, a photographer is told that it is not kept, whereas it may be in stock all the time, but known under a name different to that by which it was asked for. We here append a few names by which the same article is often designated.

Nitrate of silver; silver nitrate; argentic nitrate; lunar caustic.

Protosulphate of iron; sulphate of iron; ferrous sulphate; green vitriol.

Bichloride of mercury; chloride of mercury; mercurous chloride; corrosive sublimate.

Nitric acid; aqua fortis.

Muriatic acid; hydrochloric acid; spirit of salt; marine acid.

Sulphuric acid; oil of vitriol.

Schlippe's salt; sulphantimoniate of sodium.

Nitrate of potash; nitre; saltpetre.

Oxalate of iron; ferrous oxalate.

Oxalate of potash; potassic oxalate.

Alcohol; spirits of wine.

Methylic alcohol; wood naphtha.

Chloride of sodium; kitchen salt.

Sulphide of potassium; sulphuret of potash; liver of sulphur.

CONTENTS.

Old Style Equipment.

THE SCOVILL Portable DRY PLATE OUTFITS FOR AMATEURS.

New Style Equipment.

THE introduction of Dry Plates and the impetus given by them to the cause of Amateur Photography, created a demand for light and compact apparatus that could be easily carried about. That demand the Scovill Manufacturing Company of New York *anticipated and first met* by the introduction of apparatus especially designed for the use of amateurs.

When they announced an Outfit comprising a Camera, Holder, Tripod, Carrying Case, and a good Lens, for $10, a new era in Amateur Photography began, and it was destined to be henceforth a popular and cultivating recreation.

The Cameras they make for amateurs are not mere toys—they have been used and approved by eminent photographers. Certainly no apparatus can compare with that made by our American Optical Co.'s Factory, in durability, accuracy and elegance of finish. It is in use in all parts of the globe, and has by merit won this wide-spread reputation. Be not deceived by what is copied after it. See that your apparatus bears the brand of their actory.

Every article enumerated in this Catalogue has the guarantee of the Scovill Manufacturing Co., established in 1802, and well known throughout the world for fair and honorable dealing as well as for the marked superiority of their photographic apparatus and specialties.

New Catalogues, circulars, etc., will be mailed to any one whose address is sent with the request for copies.

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AMATEUR PHOTOGRAPHIC REQUISITES.

SCOVILL'S

NE PLUS ULTRA

APPARATUS OUTFITS.

All Articles of which are Warranted Accurate in Every Respect.

These Outfits are lighter, more compact, far handsomer and more accurate than any which are offered at the same price. Many professional photographers have bought them and use them constantly.

In each outfit the Lens, *to which stops have recently been added,* is worth the price of the whole outfit.

OUTFIT A, price $10.00, comprises

A VIEW CAMERA with *vertical shifting front or the single swing movement,* rubber bellows and folding platform, for making 4 x 5 inch pictures, with

1 Patent Double Dry Plate Holder (Reversible), also
1 Taylor Folding Tripod.
1 No. 1 "Waterbury" Achromatic Nickel-Plated Lens *with a set of Stops.*
1 Carrying Case.

OUTFIT B, price $12.00, comprises

A VIEW CAMERA with *vertical shifting front or the single swing movement*, rubber bellows and folding platform, for making pictures 5x8 inches, also

1 Patent Double Dry Plate Holder (Reversible), *with Kits.*
1 Taylor Folding Tripod.
1 No. 2 "Waterbury" Achromatic Nickel-Plated Lens *with a set of Stops.*
1 Carrying Case.

OUTFIT C, price $18.50, comprises

A VIEW CAMERA with *vertical shifting front or the single swing movement*, rubber bellows and folding platform, for making 5 x 8 inch pictures.

This Camera is constructed so as to make either a *Picture* on the full size of the plate (5 x 8 inches), or by substituting the extra front (supplied with the outfit) and using the pair of lenses of shorter focus, it is admirably adapted for taking *stereoscopic* negatives; also, by the same arrangement, two small pictures, 4 x 5 inches each, of dissimilar objects can be made on the one plate. Included in this outfit are also

1 Patent Double Dry Plate Holder, *with Kits.*
1 Large "Waterbury" Achromatic Nickel-Plated Lens, *with Stops.*
1 Pair "Waterbury" Achromatic Matched Stereoscopic Lenses, *each with Stops.*
1 Taylor Folding Tripod.
1 Carrying Case.

OUTFIT D, price $14.00, comprises

A VIEW CAMERA with *vertical shifting front or the single swing movement*, rubber bellows and folding platform for making pictures 6½x8½ inches, also
1 Patent Double Dry Plate Holder (Reversible), *with Kits.*
1 Taylor Folding Tripod.
1 No. 2 "Waterbury" Achromatic Nickel-Plated Lens *with a set of Stops.*
1 Carrying Case.

OUTFIT E, price $26.00, comprises

A VIEW CAMERA with *vertical shifting front or the single swing movement*, rubber bellows and folding platform, for making pictures 8x10 inches, also
1 Patent Double Dry Plate Holder (Reversible), *with Kits.*
1 Taylor Folding Tripod.
1 No. 3 "Waterbury" Achromatic Lens *with a set of Stops.*
1 Carrying Case.

EQUIPMENT A-A.

Consists of APPARATUS OUTFIT A, with
1 Scovill Focusing Cloth.
1 Dozen 4 x 5 Dry Plates.
1 W. I. A. Improved Ruby Lantern.
Complete for field service, Price, $12.25.

EQUIPMENT B-B.

Consisting of APPARATUS OUTFIT B, with the additional articles enumerated in A-A. (Dry Plates 5 x 8 size.)
Complete for field service, Price, $15.00.

EQUIPMENT C-C.

Consisting of APPARATUS OUTFIT C, with the additional articles mentioned in Equipment A-A. (Dry Plates 5 x 8 size.)
Complete for field service, Price, $21.50.

EQUIPMENT D-D.

Consisting of APPARATUS OUTFIT D, with the additional articles enumerated in A-A. (Dry Plates 6½ x 8½ inches.) Price, $18.00.

Where sensitive Plates are taken to a photographer's and there developed, printed from, and mounted on card-board, any of the above Equipments lack nothing that is essential. We recommend the amateur to finish his own pictures, and hence to procure one of the equipments on page 6.

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Pure Chemicals & Accessories

FOR MAKING NEGATIVES.

We offer for use with any Outfits to make pictures 4 x 5 inches, the following goods packed securely in a wooden case:

1 pkg. S.P.C. Carbonate Soda Developer,
2 4 x 5 Glossy Rubber Pans,
1 4 oz. Graduate.
1 Minum Graduate,
1 oz. Bromide Ammonium,
1 lb. Hyposulphite Soda,
1 lb. Alum,
1 bot. S.P.C. Negative Varnish,
1 doz. 4 x 5 Dry Plates,
1 Scovill Focusing Cloth,
1 W. I. A. Ruby Lantern,
1 Scovill Plate Lifter.

PRICE, COMPLETE, $5.25.

For use with any 5 x 8 Outfit we supply the same goods, with the exception of the substitution of 5 x 8 Pans and Plates for the 4 x 5 size.

PRICE, 4¼x5½ DEVELOPING OUTFIT, 5.50.

"	5 x 8	"	" 6.50.
"	6¼x8¼	"	" 7.00.
"	8x10	"	" 8.50.

BLUE PRINTS.

S. P. C.

Ferro-Prussiate Paper Outfit for Printing and Mounting 4 x 5 Blue Print Pictures.

1 4 x 5 Printing Frame.
1 4½ x 5½ S.P.C. Vulcanite Pan.
3 dozen 4 x 5 S.P.C. Ferro-Prussiate Paper.
2 dozen sheets 6½ x 8½ Card-board.
1 Glass Form (for trimming prints).
1 Robinson's Straight Trimmer.
½ Pint Jar Parlor Paste.
1 1 inch Paste Brush.

Price complete, $2.80. Securely packed in a Wooden Box.

S. P. C.

Ferro-Prussiate Paper Outfit for Printing and Mounting 5 x 8 Blue Print Pictures.

This Outfit is like the one above, but with Printing Frame, Vulcanite Tray, Ferro-Prussiate Paper and Card-board adapted to 5 x 8 Pictures.

Price complete, $3.50. Securely packed in a Wooden Box.

6½ x 8½ Ferro-Prussiate Paper Outfit. Price, $4.25.

S. P. C.

Outfit for Printing, Toning, Fixing and Mounting 4 x 5 Pictures.

1 4 x 5 Printing Frame.
1 5 x 7 Porcelain Pan Deep.
1 4½ x 5½ S. P. C. Vulcanite Tray.
2 dozen 4 x 5 S. P. C. Sensitized Albumen Paper.
1 bottle French Azotate. } For
1 " Chlor. Gold, 7½ gr. } toning.
1 2 ounce graduate.

Price complete, $4.87.

1 lb. Hyposulphite of Soda.
2 dozen sheets 6½ x 8½ Card-board with Gilt Form.
1 ½ Pint Jar Parlor Paste.
1 1½ inch Bristle Brush.
1 Glass Form (for trimming prints).
1 Robinson's Straight Trimmer.
Securely packed in a Wooden Box.

S. P. C.

Outfit for Printing, Toning, Fixing and Mounting 5 x 8 Pictures.

This outfit is like the one on preceding page, but with Printing Frame, Vulcanite Tray, Sensitized Paper, and Card-board adapted for 5 x 8 Pictures.

Price complete, $6.38. Securely packed in a Paper Box.

4¼ x 5½ Printing and Toning Outfit. Price, $5.00.
6½ x 8½ " " " " 7.00.
8 x 10 " " " " 8.50.

EQUIPMENT A-A-A.

Complete in every Requisite for making the Highest Class Pictures!

LACKING NOTHING FOR VIEW TAKING, DEVELOPMENT AND THE PRINTING AND MOUNTING OF PHOTOGRAPHS.

Consisting of *Apparatus* Outfit A.....$10 00
Also 1 *Chemical* Outfit 4 x 5 (see page 6.).... .. .. 5 25
" 1 *Sensitized Paper* Outfit, 4 x 5 (see page 7.)..... ..... 4 87

Price, $20.00.

EQUIPMENT B-B-B.

Complete in every Requisite for making the Highest Class Pictures.

Consisting of *Apparatus* Outfit B..... .....$12 00
Also 1 *Chemical* Outfit 5 x 8 (see page 6.)..... 6 50
" 1 *Sensitized Paper* Outfit (see above) 6 38

Price, $24.50.

EQUIPMENT C-C-C.

Complete in every Requisite for making the Highest Class Pictures.

Consisting of *Apparatus* Outfit C..... ....$18 50
Also 1 *Chemical* Outfit 5 x 8 (see page 6.)..... 6 50
" 1 *Sensitized Paper* Outfit (see above.)..... 6 38

Price, $31.00.

EQUIPMENT D-D-D.

Consisting of *Apparatus* Outfit D.....$14 00
Also 1 *Chemical* Outfit (see page 6.)..... 7 00
" 1 *Sensitized Paper* Outfit (see above)..... 7 00

Price, $28.00.

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INTRODUCED IN 1884.

These outfits are unsurpassed in neatness, lightness, and compactness, yet there is no question about their durability or serviceable qualities. On this account they have found favor everywhere. Each one is supplied with a patent reversing attachment, which has been styled "the lightning reverser." The whole outfit is so tasteful that many ladies have selected them for their own use.

New York Outfit 601, size 4¼x5½, consisting of
1 Finely Finished Single Swing Camera, with Folding Bed and Improved Dry Plate Holder, *with Kits.*
1 No. 1 Extension Tripod, with Patent Reversing Attachment.
1 No. 1 Waterbury Lens, *with a set of Stops,* and
1 Compact Carrying Case, with Handle. Price, $14.00.

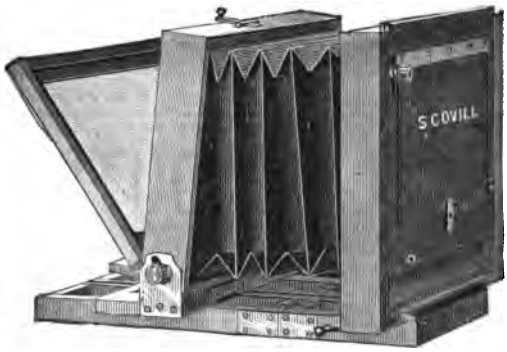
New York Outfit 601A, size 4¼x6½, same as described above, except in respect to size. Price, $15.00.

New York Outfit 602, size 5x8, same as described above, except in respect to size. Price, $16.00.

New York Outfit 603, size 6½x8½, same as described above, except in respect to size. Price, $20.00.

New York Outfits not made larger than 6½ x 8½ size

WATERBURY OUTFITS.



THE WATERBURY CAMERAS which we have introduced this season (1885), are like other cameras and apparatus now made by the American Optical Company—unapproachable!

As we have had urgent requests for 4x5 and 6½x8½ sizes of Waterbury Outfits, we are now prepared to announce our readiness to supply such sizes in addition to the 5x8 stereoscopic size. For the benefit of such as have not seen a Waterbury Camera, we present the above illustration, and add that these cameras are made of mahogany. They have rubber bellows, folding platform, single swing, vertical shifting front, side latch for making bed rigid instantaneously, and are as light and compact as substantial cameras can be constructed.

		Fitted with Eastman-Walker Roll-Holder. New Model.
4x5 Waterbuy Outfits, Complete	**$12 00**	**27 00**

CONSISTING OF

1 Single Swing Camera, described above.
1 New Style Double Dry Holder.
1 Wooden Carrying Case.
1 Taylor Tripod.
1 No. 1 Waterbury Lens *with a set of Stops.*

5x8 Watebury Outfits, Complete	**$16 50**	**36 50**

CONSISTING OF

1 Single Swing Camera, described above.
1 New Style Double Dry Holder.
1 Wooden Carrying Case.
1 Taylor Tripod.
1 No. 2 Waterbury Lens *with a set of Stops.*

6½x8½ Watebury Outfits, Complete	**$20 00**	**44 00**

CONSISTING OF

1 Single Swing Camera, described above.
1 New Style Double Dry Holder.
1 Wooden Carrying Case.
1 Taylor Tripod.
1 No. 2 Waterbury Lens *with a set of Stops.*

Latest!

4½x5½ Waterbury Outfit, complete	$14 00
4½x6½ " " "	15 00
5x7 " " "	16 00

AMERICAN OPTICAL CO.'S APPARATUS OUTFITS.

This apparatus is manufactured in New York City under our immediate personal supervision; and, as we employ only highly skilled workmen, and use nothing but the choicest selected materials, we do not hesitate to assert that the products of our factory are unequalled in durability, excellence of workmanship, and style of finish. This fact is now freely conceded not only in this country but throughout Great Britain, Germany, Australia, South America, and the West Indies.

OUTFIT No. 202, price $22.00, Consists of

A MAHOGANY POLISHED CAMERA for taking pictures 4 x 5 inches, with *Folding Bellows Body*, single swing, hinged bed, and brass guides. It has a shifting front for adjusting the sky and foreground, with

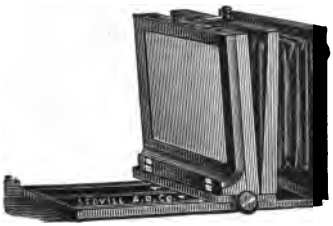
1 Daisy Double Dry Plate Holder; also 1 Canvas Carrying Case.
1 Scovill Adjustable Tripod.

OUTFIT No. 202 A, price $24.00,

The same as No. 202, but with Camera for taking pictures 4¼ x 5¼ inches.

OUTFIT No. 202 B, price $26.00, for pictures 4¼x6½ inches.

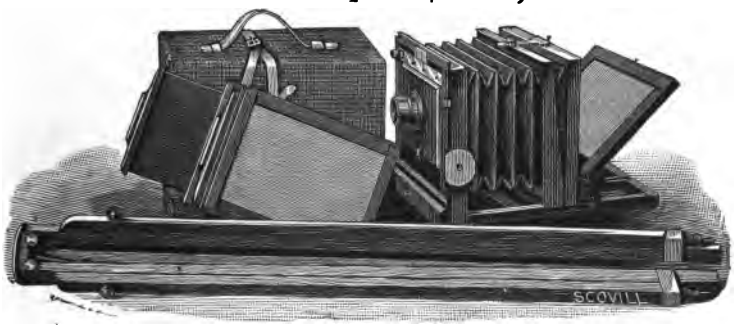
OUTFIT No. 203, price $30.00, Consists of



A FOLDING MAHOGANY CAMERA, well known as the '76 Camera (see illustration). It is adapted for taking 5 x 8 inch pictures, and also for stereoscopic views—together with

1 Daisy Double Dry Plate Holder; also
1 Canvas Carrying Case.
1 Scovill Adjustable Tripod.

OUTFIT No. 204, price $42.00, Consists of



A FOLDING MAHOGANY CAMERA of finest style and finish for taking 6½ x 8½ inch pictures, with

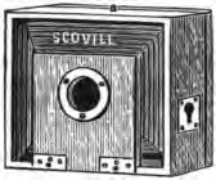
1 Daisy Dry Plate Holder; also
1 Canvas Carrying Case.
1 Scovill Extension Tripod, No. 3.

For larger or special View Cameras, consult the American Optical Company's Catalogue.

We recommend the purchase and use with the above Outfits of a Lens or Lenses selected from the list on page 24.

For Chemical and Sensitized Paper Outfits to be used with the above refer to pages 6 and 7.

TOURISTS' POCKET OUTFITS.



TOURISTS' POCKET CAMERA FOLDED.

(*Extract from* PHOTOGRAPHIC TIMES, *March*, 1888.)

AMERICAN OPTICAL COMPANY'S TOURISTS' POCKET CAMERA.

"This camera, of which a cut is appended, may be called new, as it is now advertised for the first time; but several of these cameras, both of 4 x 5 and 5 x 8 sizes, have been in use for months, and have given perfect satisfaction. When folded up, a 4 x 5 Tourists' Camera measures but 5¼ x 6½ x 2 inches, and it is without any projecting parts, pins or screws, so that it may be slipped into and not tear a gentleman's pocket. The rods which are used to move forward the front of the camera are easily detached from it and drawn out of the bed. The connector at the other end of the rods is just as readily unset. To replace these three parts when the camera is brought out for service, requires no more time or skill than to take them off. They are nicely adjusted, and are polished and nickel plated, so that they add to the handsome appearance of the camera, and contrast well with its polished mahogany surface and the purple hue of its bellows. The weight of this camera and its dry plate holder (but 1½ pounds for the 4 x 5 size) is on the center of the tripod. In focusing, the front of the camera and the lens are pushed forward, thus avoiding any disarrangement of the focusing cloth. When the focus is obtained, further movement of the lens is checked or stopped by means of a screw acting on a spring, which is pressed at the ends against the focusing rods."

NOTE REDUCTION IN PRICE.

Tourist's Pocket Outfit No. 0206.—4x5 Tourist's Pocket Camera, with
1 Daisy Double Dry Plate Holder.
1 Scovill Extension Tripod No. 1, with patent reversing attachment.
1 Canvas Carrying Case with Shoulder Strap.

Price, complete, $22.00.

Tourist's Pocket Outfit No. 0207.—5x8 Tourist's Pocket Camera, with
1 Daisy Double Dry Plate Holder.
1 Scovill Extension Tripod No. 2, with patent reversing attachment.
1 Canvas Carrying Case with Shoulder Strap.

Price, complete, $30.00.

We recommend the purchase and use with the above Outfits of a Lens or Lenses selected from the list on page 24.

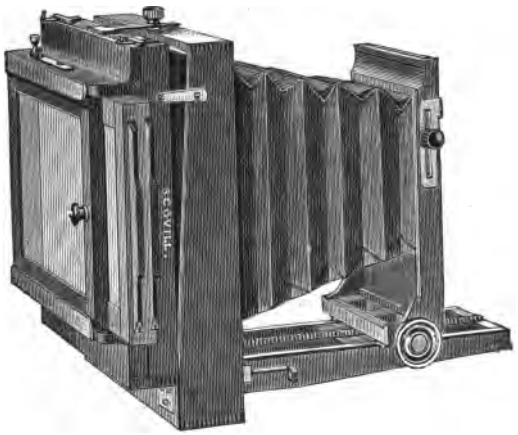
For Chemical and Sensitized Paper Outfits to be used with the above, refer to pages 6 and 7.

SAINT LOUIS

Reversible-Back Cameras.

IN addition to the desirable features which the Back Focus Reversible Camera possesses (see description below) the St. Louis Reversible-Back Cameras have the rack and pinion movement, side latch for making the bed rigid instantaneously, and the ground-glass so arranged that the holder may be slid in front of it, as shown in the illustration.

Each Camera is supplied with one Daisy Holder and canvas case.



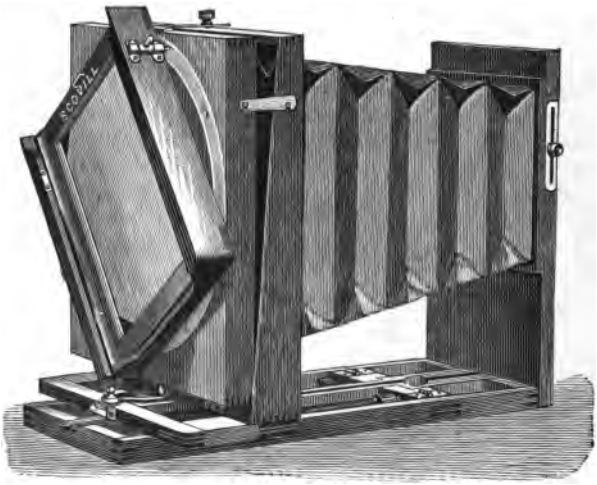
THE growing use of dry plates, and the desire for rapid exposures, led to their introduction, and because they add to the grace and celerity of view-taking they have become vastly popular. A novel arrangement of a detachable carriage at the back combines such a multiplicity of adjustments in itself that a dry-plate holder *may be reversed or be set for either an* 8x10 *upright or horizontal picture*—all of these movements, without once changing the dry-plate holder in the carriage, which may be made to take an S. G. C., but not a Bonanza Holder.

	For View.	Single Swing-back.	Double Swing-back.
Saint Louis Reversible-Back Camera,	4¼x5½,	$26 00	$30 00
" " "	5x7,	32 00	35 00
" " "	6½x8½,	36 00	40 00
" " "	8x10,	40 00	44 00
" " "	11x14,	60 00	66 00

Not made front focus above 11x14 size.

Flammang's Patent Revolving-Back Cameras.

Each Incased in a Canvas Bag, with Handle.



"These are the finest View Cameras ever constructed," so says every photographer who has examined any of them, and this exclamation is not merely a tribute to the beauty and grace of their design, for invariably the desire has at the same time been expressed to possess one of these truly novel and substantial Cameras.

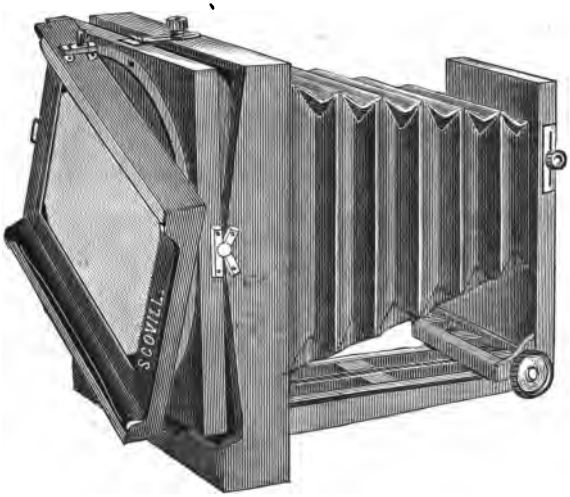
Wherein lies the merit and attractiveness of the Revolving-Back Camera, that photographers want to cast aside cameras now in use and procure one of this new pattern? Briefly stated, it enables the view taker to secure either an upright or a horizontal picture without changing the plate holder after it has been slid into the carriage. No other camera can with such wondrous ease and celerity be changed from the vertical to the upright or *vice versa*. The carriage is simply turned about in the circle and automatically fastened. By this latter provision the carriage may be secured at either quarter of the circle. Ordinarily, the slide will be drawn out of the holder to the right; but in certain confined situations, the ability to withdraw the slide to the left enables the photographer to obtain a view which he could not get with the usual provision in a camera. The photographer of experience is well aware of the difficulty, when taking an upright picture with a large camera, of reaching up to draw out the slide at the top, and, what is more essential, of getting out the slide without fogging the plate in the holder.

Grace and strength are combined in the Revolving-Back Camera, and its highly-desirable features are gained without the sacrifice of steadiness or any other essential principle in a good camera. Indeed, its merit is such that out-door photography has been advanced and made more attractive by its introduction.

For a more detailed description consult Scovill's general catalogue.

Revolving-Back Camera, Front Focus.

(Not made larger than 8x10 Size.)



PRICE LIST.

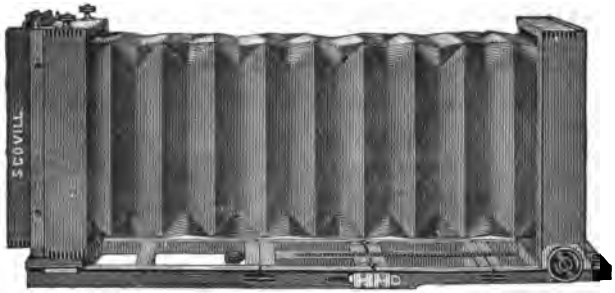
Revolving Back Cameras, each Incased in a Canvas Bag, with Handle, above 11 x 14 size, with two handles.

No.				Plain.	Single Swing.	Double Swing.
550A.	For View	4 x 5 in.,	reversible.....	$26 00	$31 00	$36 00
551.	"	4½ x 5½ "	"	28 00	33 00	38 00
551A.	"	5 x 7 "	"	30 00	35 00	40 00
551B.	"	5 x 8 "	"	30 00	35 00	40 00
552.	"	6½ x 8½ "	"	40 00	45 00	50 00
553.	"	8 x 10 "	"	45 00	50 00	55 00
554.	"	10 x 12 "	"	60 00	65 00	70 00
555.	"	11 x 14 "	"	70 00	77 50	82 50
556.	"	14 x 17 "	"	80 00	90 00	95 00
557.	"	17 x 20 "	"	95 00	105 00	110 00
558.	"	20 x 24 "	"	110 00	120 00	130 00
559.	"	25 x 30 "	"	150 00	165 00	175 00

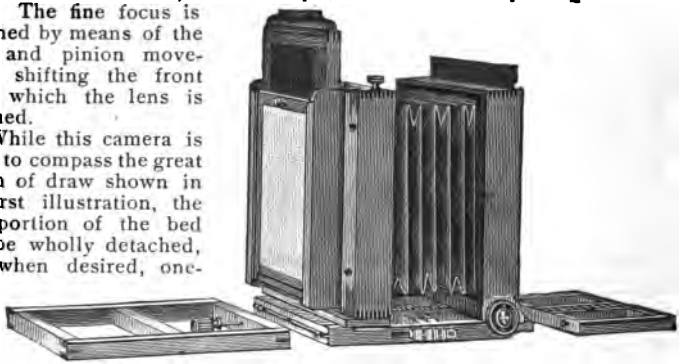
These Cameras are fitted with Daisy Dry Plate Holders.

☞ Please state, when ordering, whether front or back focus is desired.

THE SCOVILL MANIFOLD CAMERA.



The Manifold Camera has special advantages peculiar to itself and possesses the greatest number of desirable features which can be combined in a camera without sacrificing lightness and compactness, or having complicated adjustments. The unique device which controls the horizontal and vertical swings was patented by Mr. W. J. Stillman, of the editorial staff of the PHOTOGRAPHIC TIMES. *To this has been added a central latch for the purpose of bringing the swing movements within perfect control of the operator.* An approximate focus is obtained quickly with the rear portion of the camera, which is provided with the patent reversible back. The fine focus is obtained by means of the rack and pinion movement, shifting the front upon which the lens is attached.



While this camera is made to compass the great length of draw shown in the first illustration, the rear portion of the bed may be wholly detached, and when desired, one-third of the remaining portion of the platform; a great advantage when photographing interiors, when an obtrusive tail board renders focusing almost an impossibility. With one-half of the bed taken off, this camera is still of the usual length of draw. The ground glass, when not in use, is displaced, *not detached*, by having the plate holder slid in front of it. This arrangement of ground glass and plate holder is shown in the second view. Still another noticeable feature is the absence of clamping screws from the front boards, to move which one needs but to press firmly against the lens. The bed folds in front of and behind the camera, and has the side latch recently devised at the American Optical Co.'s factory. While this camera serves manifold purposes, as its name indicates, nothing could be more simple or more easily manipulated. PRICE LIST, including Canvas Case for Camera and one Holder.

3¼x4¼ size... $34 00	4¾x6½ size.....$41 00	6½x8½ size.....$52 50
4x5 size..... 38 00	5x7 size..... 42 00	8x10 size. 58 00
4¼x5½ size.... 40 00		

Other sizes made to order.

Photographic Outfits for Bicyclists,

WITH WHICH TO SECURE MEMENTOES OF PLEASANT EXCURSIONS.

So popular has amateur photography become among wheelmen that the two amusements are now almost identical. The "Wheel" allows unbounded opportunities to the amateur photographer to gather choice landscape views, which he could not get otherwise.

"NE PLUS ULTRA" BICYCLISTS' PHOTO-OUTFIT

(COMPLETE).

PRICE, - - - $10.00.

Consisting of a 3¼x4¼ Imitation Mahogany Camera with Vertical Shifting Front, Folding Bed and Hinged Ground Glass,

A UNIVERSAL JOINT BICYCLE ATTACHMENT,

A No. 1 WATERBURY LENS (NICKEL-PLATED), *with Stops*,

A CANVAS BAG TO CARRY THE ABOVE, *with Shoulder Strap*.

The advantages of this outfit are its Lightness and Compactness, and the ease with which it can be brought into use—a new device on bed of the Camera permitting it to be made rigid, or to fold instantaneously. There are no loose pieces. The outfit complete weighs 2 pounds 3 ounces.

NICKEL-PLATED BICYCLE ADJUSTABLE SUPPORT.....$1.50

This has no loose pieces and is so accurately made as to have no side play.

THE "MIGNON" BICYCLISTS' PHOTO-OUTFIT

(COMPLETE).

Consisting of a 3¼x4¼ Finely Polished Mahogany Camera, with Swing Back, Vertical Shifting Front, Hinged Ground Glass, Folding Bed, Rack and Pinion Movement (Front Focus). In short, it has every improvement, and has no loose pieces. Nothing finer, more attractive and yet simple was ever made.

A Universal Joint Bicycle Attachment.

A 5½ inch Morrison Wide-Angle Instantaneous Lens, pronounced by authorities on optics to be without a peer. The Rotary Shutter with this Lens is the Most Compact and the Lightest known.

A Canvas Saddle Bag lined with flannel to prevent marring of the fine finish of the camera.

THIS OUTFIT COMPLETE WEIGHS LESS THAN TWO POUNDS.

Price of "Mignon" Bicyclists' Photo-Outfit Complete, $70.00.
Without Lens, $25.00.

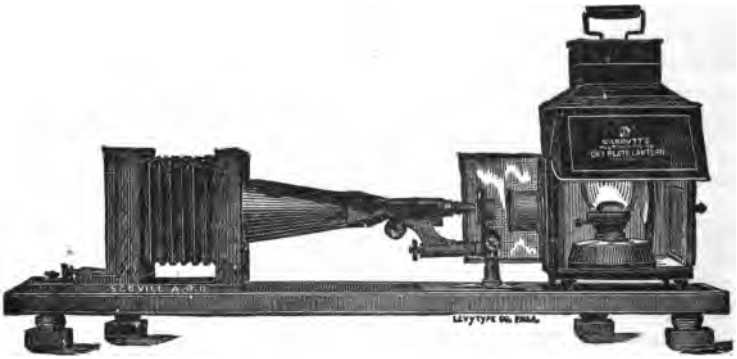
With the lenses just described, clear, sharp pictures can be obtained which will make fine transparencies and lantern slides, or which can be enlarged up to 8x10 size.

SCOVILL'S OUTFIT

For PHOTOGRAPHING with the MICROSCOPE.

Photographing with the microscope has hitherto been accomplished by the aid of elaborate and costly apparatus, and been applied chiefly to making illustrations for scientific magazines. The process used, that of wet collodion in connection with sunlight, involved the procurement of an expensive heliostat to produce a steady illumination, for with any less powerful light the exposure would necessarily be so prolonged that the coating of the plate would dry and become useless. Now all this is changed, for with the modern improvements in photography which are the result of the introduction of gelatine dry plates, the photographing of microscopic objects becomes as easy of accomplishment as the photographing of the beautiful and visible in nature is with the popular amateur outfits.

The scientist and microscopist, instead of spending hours in making imperfect drawings, aided by the camera lucida, may in a few minutes, with the assistance of photography, produce a more perfect representation of a minute object than it is possible for the hand of man to do, working conjointly with the eye. Not only can an enlarged image of a microscopic object be formed for illustration, but professors in colleges will find it a ready means to produce negatives of a suitable size from which may be made transparencies or magic lantern slides for exhibition to classes or the public.



If this is done in the daytime, a room from which all white light is excluded should be selected ; but if used at night, as in most cases it would be, the operations may all be performed in the midst of a family group for their interest and amusement, and to impart to them knowledge of the minute life or organisms of the world which the microscope alone can reveal.

Scovill's Photomicroscopic Equipment,

— CONSISTING OF —

1 Scovill Special Half Plate Camera.
1 Multum in Parvo Lantern, with Double Condenser.
1 dozen 4½ x 5½ size B Keystone Plates to make Negatives; also
1 dozen 3½ x 4¼ size A Plates for Transparencies.

Price, Complete, $18.00.

The presumption is that you are provided with a microscope. If not, we recommend the purchase of one from a regular dealer in microsoopical goods.

Circular containing directions for use sent with each outfit.

MERCER PHOTOMICROGRAPHIC

CAMERA.

Size, 2¾x3¼.

——Price, $6.50.——

This Camera is provided with a Brass Cone and Plate Holder with Ground Glass attached, to slide back and forth in the carriage, as desired.

THE SCOVILL DETECTIVE CAMERA.

It has not come to be generally known, but such is the fact, that Artists of renown and shrewd Detectives carry about these Cameras, and pictures are secured by them for their different lines of study through their instrumentality in a manner which is perfectly simple—in fact, it requires no skill other than to get within the range of focus of the unsuspecting victim. As the party, whether man, woman, or child, is not aware that anything unusual is transpiring, the expression of the countenance and the pose are not arranged with reference to their appearance in a picture. A quick working lens is hidden in the camera, and also a few plate holders. By pressing on a spring the whole operation of exposure is completed.

It followed naturally upon the introduction of the Roll Holder that it should be applied to the peerless SCOVILL DETECTIVE CAMERA, and this has been done in a manner that displays the greatest ingenuity. Instead of three double dry-plate holders, but one will accompany the Roll Holder.

Scovill's Roll Holder Detective Camera, for 3¼x4¼ Pictures, with Morrison Lens.....$65 00

Scovill's Roll Holder Detective Camera, for 4x5 Pictures, with Morrison Instantaneous Lens..... 75 00

The price for the 3¼x4¼ Scovill Detective Camera, with Morrison Lens, three double Dry-plate Holders, and room in the case for six double Holders..... 50 00

The price for the 4x5 Scovill Detective Camera, with Morrison Lens, three double Dry-plate Holders, and room in the case for six double Holders..... 60 00

Many amateurs have declared that the pleasure of picture-taking was not fully revealed to them until they had procured and tried one of the SCOVILL DETECTIVE CAMERAS.

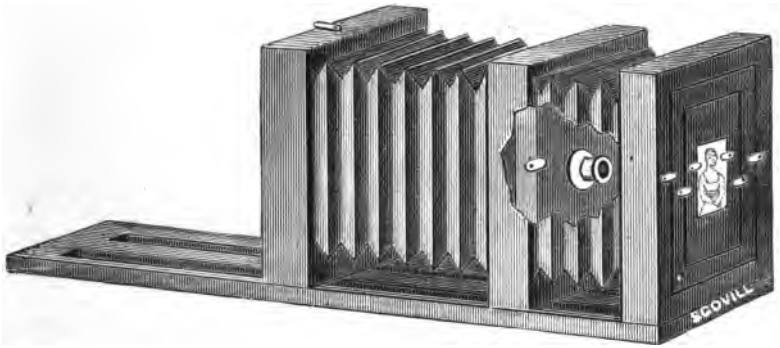
Scovill's Outfit for Making Lantern Slides consists of

1 doz. Thin Crystal Glass.
2 " Black Mats.
1 package Black Adhesive Paper.
1 doz. 3¼x4¼ Gelatino-Albumen Dry Plates.
1 package S. P. C. Pyro and Potash Developer.
2 4¼x5¼ Solid Glass Pans.
1 lb. Hyposulphite Soda.

The above, packed in wooden case, price complete..... $3 50

For enlarging, reducing, or copying Negatives to make Lantern Slides, we recommend the use of one of the Scovill Enlarging, Reducing and Copying Cameras.

The Scovill Enlarging, Reducing and Copying Cameras.



When ordering, please specify number and sizes of kits wanted.

Size, 6½x8½,	Price, $30.00	Size, 11x14,	Price, $60.00
" 8x10,	" 35.00	" 14x17,	" 72.00
" 10x12,	" 48.00		

Size, 14 x 17, - - $72.00.

Special sizes and styles made to order.

The form of construction of this new Camera is made apparent by the illustration here shown. The experienced copyist will not need any such simple directions for use as we append.

DIRECTIONS FOR USE.

To copy a negative in the natural size, place it in the kit on the front of Camera and button it in. Attached to the center frame of the Camera is a division upon which, on the side toward the Camera front, a Lens is mounted. Suppose this to be a quarter-plate Portrait Lens, the focal length of which we will suppose to be 4 inches—draw back the center frame and the Lens twice the focal length of the Lens (8 inches); slide the back frame with ground glass the same distance from the center frame. To enlarge with the same Lens to eight times the size of the original, the center of the Lens must be 4½ inches from the negative, and the ground glass be 36 inches from the center of the Lens. To reduce in the same proportion, reverse and have 36 inches from the center of the Lens to the negative, and from the center of Lens to ground glass 4½ inches.

KILBURN GUN CAMERA,

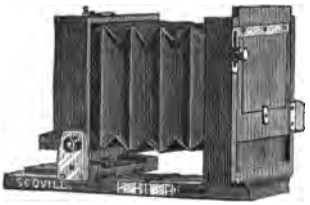
For 4 x 5 Pictures.

Price, $27.00.

Gunstock Attachment only $5.00.

A popular method of hunting lately introduced is in conformity with the laws of Mr. Bergh's Society for the Prevention of Cruelty to Animals. It never results in the death or even maiming of fish, flesh, or fowl, yet all three may be easily bagged. The weapon used is a late invention called the gun camera. It consists of a small camera mounted on a gunstock and provided with sights and triggers. Its ammunition is chemicals instead of powder and lead. It is both breech and muzzle loading, is light and simple in construction, and is used like an ordinary shot-gun. When a bird rises, it must be brought to the shoulder, a dead aim taken at the feathered object, and the trigger pulled. There is a slight shock as of an explosion, the bird flies on to cover unharmed, leaving its picture on the sensitive plate in the camera. It is all done in a moment of time. The plate is removed, another inserted, and the hunter is ready for the next object. The amateur may go forth with two dozen dry plates as his stock of ammunition. If he fire with precision at any stationary or moving object, he may be absolutely sure of bringing it down.—*New York Tribune.*

THE PETITE CAMERA.



This camera was made to suit the refined taste of one of Vassar's fair students. The design on the part of the manufacturers was to reduce the impedimenta for an outing to the minimum, providing a 3¼x4¼ camera (to make negatives of suitable size for lantern slides), with single swing, folding bed, vertical shifting front, and other desirable improvements. So well has the design been carried out that many ladies will follow the example of Vassar's pupils, and learn the fascination of picture-taking with one of these finely-polished mahogany cameras. Gentlemen in search of a pocket camera need not seek further. The Petite Camera and an enlarging camera will by many be considered a satisfactory and complete equipment for such photographing as they desire to do.

PRICE.

Petite Camera with one double dry-plate holder.....$12 00
Same Camera with Scovill's adjustable (feather weight) tripod and canvas bag, with shoulder strap..... 17 00

WATERBURY LENSES.

Provided with a Set of Stops.

Notwithstanding what may be said or imagined to the contrary, it is a fact that many of the most exquisite photographs ever produced have been taken by the single achromatic lens, which is composed of a bi-convex lens made of crown glass, cemented by a transparent medium to a plano-concave lens formed of flint.

PRICE.

No. 1, Single.....	$3 50	No. 2, Single.....	$4 50
" 1, Matched pair	7 00	" 3, "	8 00

OUTFITS FOR INSTANTANEOUS PHOTOGRAPHY.

Instantaneous Outfit No. 401.

CONSISTING OF

202 Outfit	$22 00	
Peerless Lens	12 50	
Instantaneous Drop (wood) for front of Lens	1 50	— $35 00

Instantaneous Outfit No. 402.

202 Outfit	22 00	
No. 1 Darlot Rapid Hemispherical Lens	15 00	
Instantaneous Drop (wood) for front of Lens	1 50	— 38 00

Instantaneous Outfit No. 403.

202 Outfit	22 00	
Morrison's Celebrated B Group Lens, with metal Drop	35 00	— 56 00

Instantaneous Outfit No. 404.

203 Outfit	30 00	
No. 2 Darlot Rapid Hemispherical Lens	25 00	
Instantaneous Drop (wood) for front of Lens	1 50	— 56 00

Instantaneous Outfit No. 405.

203 Outfit	30 00	
Morrison's Celebrated C Group Lens, with Instantaneous metal Drop	40 00	— 69 00

The same Chemicals and Printing Requisites can be procured for the above as for common Outfits.

Lenses for Obtaining Instantaneous Pictures.

B Morrison's Celebrated Group Lens, with metal Drop	each,	$35 00
C " " " " "	"	40 00
CC " " " " "	"	50 00
No. 1 Darlot Rapid Hemispherical Lens, with wood Drop	"	16 50
" 2 " " " "	"	26 50
" 3 " " " "	"	36 50
Imitation Dallmeyer Lens	"	9 50
" " Lenses, matched for Stereoscope Work, per pair,		17 00

Morrison's Wide-Angle View Lenses.

PATENTED MAY 21, 1872.

These Lenses are absolutely rectilinear; they embrace an angle of fully 100 degrees, and are the most rapid *wide-angle* lenses made.

No.	Diameter of Lens.	Size of Plate.	Equivalent Focus.	Price, Each.	
00	⅜ inch	2½ x 2½ inches	1⅞ inches	$25 00	These 3 sizes will fit into 1 flange.
0	½ "	3 x 3 "	2¼ "	25 00	
1	¾ "	4 x 4 "	3 "	25 00	
2	1 "	4 x 5 "	3½ "	25 00	These 5 sizes will fit into 1 flange.
3	1 "	4½ x 7½ "	4½ "	25 00	
4	1 "	5 x 8 "	5¼ "	25 00	
5	1 "	6½ x 8½ "	6¼ "	25 00	
6	1 "	8 x 10 "	8 "	30 00	
7	1¼ "	11 x 14 "	10½ "	40 00	These 2 sizes will fit into 1 flange.
8	1½ "	14 x 17 "	14 "	60 00	
9	1¾ "	17 x 20 "	17 "	80 00	These 2 sizes will fit into 1 flange.
10	1¾ "	20 x 24 "	22 "	120 00	

REMARKS.—Nos. 1 to 6 are all made in matched pairs for stereoscopic work. The shorter-focused Lenses are especially adapted for street and other views in confined situations. For general purposes, a pair of No. 5 Lenses will be found most useful.

Morrison's Instantaneous Wide-Angle View Lenses.

With full opening, these lenses have all the extreme depth for which the Morrison Regular Wide-Angle Lenses are noted. They work with extreme rapidity, and will cover an angle of 90 degrees sharp. Furnished with a pneumatic drop and a set of diaphragms.

Diameter of Lens.	Size of Plate, Full Opening.	Size of Plate when Stopped Down.	Focus.	Price.	With Rotary Exposer.
⅞ inch.	4 x 4 inches.	5 x 7 inches.	5½ in.	$30 00	
1 "	4 x 5 "	8 x 10 "	8 "	35 00	
1¼ "	5 x 8 "	10 x 12 "	10 "	40 00	$60 00
1⅝ "	8 x 10 "	14 x 17 "	13 "	45 00	65 00

Protectors for any of above Lenses..... $12 00
" C Group Lenses..... 12 00
" CC " " " 17 00

Darlot Hemispherical Wide-Angle Rectilinear View Lenses.

These Lenses embrace an angle of 90 degrees, and are valuable for taking views of buildings, interiors, etc., in confined situations, where those of longer focus cannot be used.

	Back Focus.	Size View.	Price.
No. 1,	2½ inches	For Stereoscopic Work, each	$12 50
" 2,	3 "	" " "	15 00
" 3,	5 "	8 x 10	20 00
" 4,	8 "	10 x 12	25 00

Darlot Rapid Hemispherical View Lenses.

These Lenses embrace an angle of from 60 to 75 degrees; are quick-acting, perfectly rectilinear, and provided with central stops. Will be found very fine lenses for landscape and outdoor groups; also for copying engravings, maps, architectural subjects, etc.

	Back Focus.	Size View.	Price.
No. 1,	5½ inches	5 x 6	$15 00
" 2,	9 "	5 x 8	25 00
" 3,	10½ "	8 x 10	35 00

No. 1 can be had in matched pairs for Stereoscopic work.

Scovill's "Peerless" Quick Acting Stereoscopic Lenses,

FOR PORTRAITURE OR VIEWS.

The Lenses are especially designed for Stereoscopic Photography, and are so constructed that they will work well for interiors or exteriors.

They are particularly adapted for instantaneous work.

Diameter of Lenses, 1⅛ inch; focal length, 3⅛ inches.

By removing the back lens and substituting the front combination, a focal length of 5⅛ inches is obtained.

They are supplied with six Waterhouse diaphragms in morocco case.

Price, per pair..... $25 00 | Waterbury View Finder..... $3 00

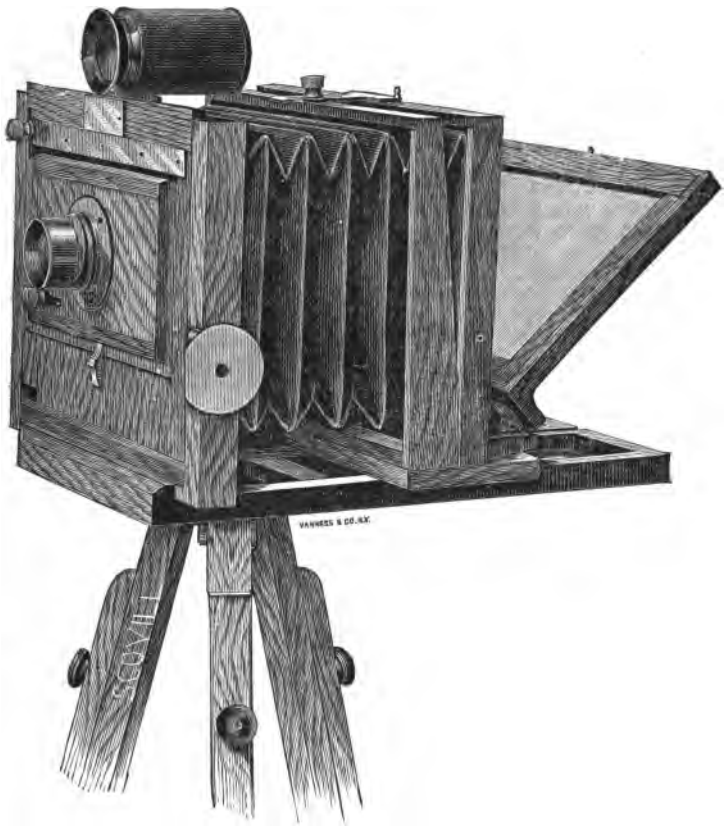
ALL STYLES OF LENSES SUPPLIED.

A New Departure in Morrison Wide-Angle Lenses.

(*Extract from* PHOTOGRAPHIC TIMES, *Vol. xiv, page 277.*)

Opening the velvet-lined morocco case presented to us for our inspection, we find partitioned-off space containing an ordinary 5-inch Morrison Wide-Angle Lens, on which the front and back combinations are distinctly marked with the figure 5. Beside this, in cells, are four mountings with lenses of varying focal lengths, each marked in white with a number. By unscrewing the back combination marked 5, and putting in its place the mounting marked 6, a lens of 6-inch back focus is obtained. Again, by removing both these cells and replacing them with the two marked 8, a lens of 8-inch back focus is the result. By screwing in the front combination marked 5 and the back combination marked 4, a lens of 4-inch back focus is obtained. Putting a front combination marked 8 and a back marked 6, a focus of 7 inches is produced. Thus the operator has a choice of five focal lengths with the one lens. Price for the whole, $80.

A complete descriptive Price List of Outfits, Accessories, Dry Plates, Chemicals, Transparency Frames, Dry Plate Holders, and View Albums, accompanies each Outfit, or is mailed free upon application.



'76 Camera, with Morrison Lens and Waterbury View Finder.

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